the Petroleum Engineer

An International Monthly

APRIL • 1949

VOLUME XXI NUMBER 4

ALL DIVISIONS

The PETROLEUM ENGINEER Publishing Company

Irwin-Keasler Building
Dallas 1, Texas

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GENERAL

Count on Oil for the Years Ahead! A-41
New Method for Measuring Piston Operating Temperatures A-46
New Tests Study Butane-Propane Engines A-48
The Luck of Henry Rouse, *by Harry Botsford* A-53
Preventive Maintenance Cuts Tractor Cost, *by Walter W. Black* A-63

Features

Course of Oil A-4
Highlights in Oildom A-8
Scanning Washington's Oil Horizons A-10
National Petroleum Situation A-12
Letters to the Editors A-14
Meetings A-18
Petrolic Personalities A-20
Petroleum Profile—Dean A. McGee A-60
Laugh With Barney A-66
News A-68
Petroleum Data—United States Petroleum Imports and Exports Situation A-72
Petroleum Chart—U. S. Imports and Exports A-73
Personals A-75
Classified Advertising A-78
The Petroleum Engineer's Continuous Tables (Installment No. 142) E-1
Machinery and Equipment E-17
Trade Literature E-28
Book Reviews E-31

EXPLORATION, DRILLING, AND PRODUCTION — *K. Marshall Fagin, Editor*

Offshore Seismic Exploration in Gulf, *by Virgil W. Teufel* B-7
Offshore Drilling Problems in the Gulf, *by K. Marshall Fagin* B-12
Magnetic Device Measures Stress on Pipe in Wells, *by Philip W. Martin* B-32
Giant Diesel Electric Barge Rig Operating on Maracaibo, *by E. H. Lamberger* B-38
Gulf Activity Spurred by 11 Discoveries, *by Dean A. McGee* B-54
Inside of Rocks Shown in Movies B-68
California Regains Deepest Well Record, *by Richard Sneddon* B-70
Corrosion Problem in Offshore Drilling, *by Arthur E. Burns, Jr.* B-86
Offshore Exploration With Gravity Meter and Magnetometer, *by Eugene W. Frowe* B-92
The Coast Guard Looks at Offshore Petroleum Developments, *by J. A. Kerrins* B-97

Features

Editorial—Petroleum Reserves Under the Sea B-3
What's Doing in Drilling B-102
Exploration Activities B-106
Running Tour B-110
News B-120

REFINING AND NATURAL GAS PROCESSING — *Arch L. Foster, Editor*

Ashland Modernizes Wartime TCC Units, *by A. W. Hoge and William Tiernan* C-7
Worker Consistometer Used for Study of Lubricating Greases C-10
Electronic Leak Detection, *by Richard Sneddon* C-11
High LPG Recovery at New California Plant, *Part 2, by M. E. Garrison* C-13
Platforming Improves Motor Fuels, *by Edwin F. Nelson* C-22
One Way to Treat Spent Caustic, *by J. C. Albright* C-32

Features

The Turnaround C-3
Plant Aids C-36
News C-39
Personals C-44

PIPE LINE AND MARINE TRANSPORTATION — *Frank H. Love, Editor*

Initial Stage Michigan-Wisconsin Line, *by Frank H. Love* D-5
Natural Gas Service Center, *by Robert M. Hutchison* D-9
Electrification of Petroleum Pipe Lines, Part 1, *by M. A. Hyde* D-13
Supertanker Launched D-18
Pipe Line Casing Seals Fabricated, *by Don L. Hill* D-20

Features

The Firing Line D-3
News D-22
Pipe Line and Marine Transportation Personals D-26
With the Pipe Line Contractors D-28
Transportation Pictorial D-32
Pipe Line Projects D-30
Marine Operations D-34

The Petroleum Engineer, published monthly, August through June, semi-monthly in July, by The Petroleum Engineer Publishing Company, Seventh Floor, Irwin-Keasler Building, Dallas, Texas. Subscription rate to the petroleum industry, United States and Foreign, $3.00 per year, $5.00 for two years; 25c a copy or back copies over 3 months old, 50 cents. Entered as second-class mail matter May 1, 1932 at the post office in Dallas, Texas, under the Act of March 3, 1879.

VALID SUGGESTIONS

We must continue our present conservation practices, both to prevent waste and to promote the maximum ultimate recovery of oil and gas. It is upon this foundation that the Interstate Oil Compact has been built. It was the amount of oil saved by such conservation practices that gave us the oil necessary to win World War 2. Time has demonstrated that State control of conservation has been far more effective and efficient than Federal control. In addition, State control has given maximum encouragement to development, whereas Federal control of the public lands has witnessed a series of battles to overcome Interior Department policies that have retarded development.

Neither the Congress nor the States should pass any legislation that will impair the validity of the oil industry. We must not give heed to political propaganda favoring the stock-piling of oil, restricting domestic production in favor of foreign oil, and price control that would discourage or prevent exploratory work necessary to find new sources of oil supply. Equally important with the promotion of conservation is the promotion of new discoveries. This involves the expenditure of huge sums of venture or risk capital, which can come only from earnings. The States have for years successfully regulated production in order to prevent waste, and the Federal Government must not permit excessive imports of foreign oil to cause irreparable waste and injury to what is perhaps our most essential natural resource, petroleum supply, which is sufficient to supply the oil and gas needs of our Nation during the foreseeable future.

We must plan for the future with the utmost care; encourage technology or scientific research, an essential ingredient of our oil economy; prepare for utilization of liquid fuel from oil shales, coal, tar sands, and agricultural products. Thus we can supplement our petroleum supply when and as needed; restore the power to the States to develop the so-called tidelands, encourage voluntary unitization and secondary recovery, and build again as we did prior to World War 2 an excess reserve of oil supply, which will provide at minimum cost a reserve available for immediate expansion in case of an emergency.

In general, the Federal and State governments should continuously cooperate in the conservation of the petroleum resources of the Nation and States, with the purpose that neither the Federal Government nor the States shall surrender or lose any of their powers, but that each shall exercise its power to further a common policy of conservation.

The foregoing suggestions are the substance of a resolution unanimously adopted last month at Topeka, Kansas, by the Executive Committee of the Interstate Oil Compact Commission. Directed to the Federal Government and to the States, the suggestions are valid and timely and, if heeded, could form a reliable basis for action in matters involving oil and gas resources.

K. C. S.

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HIGHLIGHTS in Oildom

Not Independents but Interdependence. Speaking on the subject, "Tomorrow's Oil Industry—Dynamic but Stable," President L. F. McCollum addressed approximately 600 oil men at the closing banquet of the annual meeting of the North Texas Oil and Gas Association, Wichita Falls.

"In 1948 the oil industry drilled 39,778 wells for an all-time record, and here the performance of the independent operators really stands out. Of those wells, 73 out of every 100 were drilled by independents, and 27 out of every 100 by the 27 large companies. The oil industry put down 6827 wildcats in 1948, with the 27 large companies drilling only a little over 19 per cent, while the independent producers drilled 81 per cent. It is estimated that 35 per cent of the total output of crude in the United States during 1948 was from producers who are not among the 26 largest operators."

These figures reveal the interwoven fabric of the oil industry despite the much stressed difference between "Independents" and "Big Corporations." That the small operator takes chances that would probably get the exploration manager of a large corporation fired. Large companies sometimes buy up areas of discovery and develop oil production. The small operator will sell his production and put the money into more drilling, both of wildcats and development wells.

To the industry both the small operators and the large ones have their place and each size needs the other. It is well to remember there are more points of meeting than of division.

Federal Leasing Change. Beginning March 1 a $10 filing fee that is paid for an oil and gas government lease on public lands is to be retained by Bureau of Land Management of U. S. Department of Interior as service charge. Payment of full year's rental for land is also to be required with filing of application.

"Louisiana Story." One of the 10 best motion pictures of the year, say critics, is "Louisiana Story," financed by Standard Oil Company (New Jersey).

Made by Robert Flaherty, the outstanding documentary producer, "Louisiana Story" is a story of the search for oil in Cajun bayou country as seen through the eyes of a native boy.

The picture took three years in the making, costing Standard Jersey about $225,000. Flaherty has two years' exclusive rights to show, then the rights go to Standard.

Farmers Increase Oil Demand. Purchase of mechanized farm equipment in 1948 reveals the solid basis for increased demand for petroleum products by U. S. farmers. Released by the U. S. Department of Commerce are figures showing that in 1948 buying of mechanized farm equipment rose 52 per cent over 1947 and 269 per cent over 1939.

Rare Words. There are times when communication by word or writ becomes so complicated that special keys are needed to explain explanations. All too rarely does a handbook come out that anyone who can read English can readily understand. For great clarity, simplicity, and completeness Jones and Laughlin Steel Corporation has provided a model of communication in "Wire Rope Is a Machine."

Insured Venture Capital. Sounds like a paradox but that is what American Oil Explorers, Inc., new Oklahoma City company, proposes to achieve. Buyers of stock will be issued a life insurance policy in an amount equal to the investment. Berkeley C. Deardorf is president of the new concern.

State Violations. Fifty-six notices were sent to oil operators by the Illinois State Oil and Gas Division bearing a 15-day warning to heed various regulations or be subject to fines. Principal violations charged were salt water seepage endangering livestock, lack of fire walls around wells, etc.

Information to Commerce Department. By 1956 the U. S. will probably have to import about 195,000 bbl of oil a day because of the steady shift from coal to oil for fuel, prophesied the U. S. Department of Commerce in March.

It might be interesting to the Commerce Department to learn that our imports for March were about 600,000 bbl a day.

This seems to be carrying futile forecasting to unnecessary limits.

Britain Wants Dollars for Oil. Britain plans to increase the sale of oil to dollar markets as part of its drive to bridge the dollar gap. Sir Frederick Bain, president of the Federation of British Industries, outlined Britain's trade plans to the British commonwealth chamber of commerce in the United States. He spoke as United Kingdom chairman of the Anglo-American council on productivity.

The British government and industry will make the attack on the dollar gap their main object in 1949, Sir Frederick said.

Scientists Honored. Three petroleum technologists were honored at the fourteenth mid-year meeting of the refining division, American Petroleum Institute, in Houston, Texas. The API's certificate of appreciation was presented to Walters Samans, Sun Oil Company, Philadelphia; Kenneth G. Mackenzie, The Texas Company, New York, and Thomas G. Delbridge, retired, Atlantic Refining Company.

Proposes Census. A National Petroleum Council committee urged that a census of the petroleum industry be taken in 1950 to cover operation of 1949.

The committee recommended that the oil industry be allowed to collaborate with the census bureau in the survey. It said collaboration would be "through appointment of a small committee of statistical experts from the industry to assist in drawing up schedules on which the census will be taken."

It added that the data gathered would help "avoid and refute misrepresentations concerning the industry that are based upon inaccurate or incomplete material."

World Premiere. The romance of the oil industry in Oklahoma provides the theme for the motion picture, "Tulsa," which had its world premiere in Tulsa April 13. Susan Hayward and Robert Preston are the stars. Promotion included a display of $5,000,000 worth of equipment and a prize of an oil lease with well to be drilled to be given on "Stop the Music" radio show.

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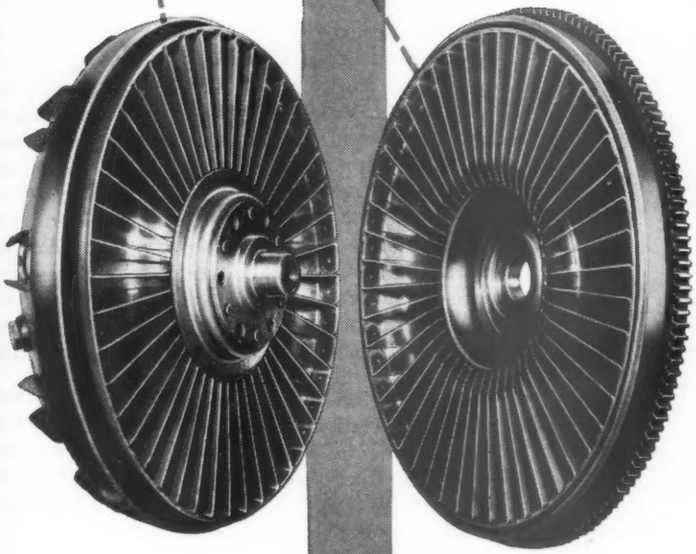

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Scanning WASHINGTON'S OIL HORIZON

By MILBURN PETTY

WASHINGTON—Ambitious plans of the British and the Dutch for overseas oil development under the Marshall Plan are worrying U. S. domestic producers as well as American companies operating abroad, fearful that dollar oil may be driven from the world market.

For once, the independent producer is sympathetic with American foreign operators, knowing that if oil from the Caribbean or the Middle East is shut off from Europe it will try to find a market in this country.

Economic Cooperation Administration admits that "somebody may get hurt" under ECA's oil program but hopes that the American industry won't be hurt more than is necessary. But petroleum is the best dollar-producing crop that ECA can plant with Marshall Plan funds. And ECA's job is to rehabilitate Europe with the expenditure of as few of the U. S. taxpayer's dollars as possible.

▸ **ECA Looks to Oil.** Here's how ECA reasons it out: Europe can not only conserve its dollars by using more sterling (British and Dutch) oil but Europe can also acquire dollars by selling more sterling oil in dollar markets. So, ECA is prepared to provide dollars for expansion of oil facilities in sterling areas. This line of reasoning was attacked by a few senators during debate over extending the Marshall Plan. They argued that it meant using taxes paid by the American oil industry to build up competitors to take away their markets.

▸ **Program of U. K.** The $500,000,000 oil program submitted by the United Kingdom, including $400,000,000 for development in the Caribbean, Far East, and other overseas areas, was attacked—but unsuccessfully—by these senators. They cited this program as evidence that the British and Dutch companies are aiming at far more than their prewar share of the world oil market, predicting that sterling oil will be invading U. S. markets, even those at home.

▸ **Import Fight.** Undaunted by the failure of Congress to heed their plea for limitation of imports, Independent Petroleum Association of America is mapping its strategy for continuing the fight and enlisting public opinion, believing that imports constitute a threat to national security by endangering our self-sufficiency in petroleum.

With a similar aim, the Texas Independent Producers and Royalty Owners Association requested the House Small Business Committee to schedule hearings in Texas on the impact of imports on domestic producers. Chairman Patman (Democrat, Texas) has agreed. Hearings probably will be held at Dallas the last week of May.

▸ **Mexican Oil.** It would not be surprising if the Export-Import Bank soon sets up a credit of about $10,000,000 for Petroleos Mexicanos to purchase drilling equipment in the U. S. Antonio J. Bermudez, director general of Pemex, has spent several weeks in Washington pushing for a much larger program—perhaps as much as $200,000,000—for expansion of Mexican oil production, refining, and transportation facilities. But it is more likely that a "token loan" will be the final outcome.

Meanwhile, operations are about to start under the "drilling contract" negotiated with Pemex by Edwin W. Pauley, Los Angeles oil man, Ralph K. Davies of American Independent Oil Company and S. B. Mosher of Signal Oil and Gas Company, with reimbursement for all costs and expenses out of 50 per cent of production, plus a profit of 15 per cent on oil from findings on upland structures, 16¼ per cent from sheltered waters and 18¼ from offshore submerged lands.

▸ **Tidelands.** Texas officials, as well as Texans in Congress and within the Truman Administration, are talking about a compromise settlement of the tidelands oil issue. Their idea is that Texas should control development of submerged areas within the 10½-mile limit (three miles out for the other states) and receive the larger share—say two-thirds—of the royalties and the federal government, one-third; outside this area the federal government would control development and receive the larger share of the royalties. Whether President Truman will go along, remains to be seen.

▸ **Gas Bill.** Supporters of the Lyle-Harris Bill to exempt independent producers and gatherers of natural gas from the Federal Power Commission's jurisdiction made out a good case at hearings beginning April 5. However, the FPC got a postponement of its appearance until April 25. It can be expected that the Olds-Draper faction in FPC will wage an all-out fight against the measure, using all weapons—including attacks through certain newspapers—as they did against the Rizley-Moore Bill in the 80th Congress. But the chances are much brighter for the bill this time.

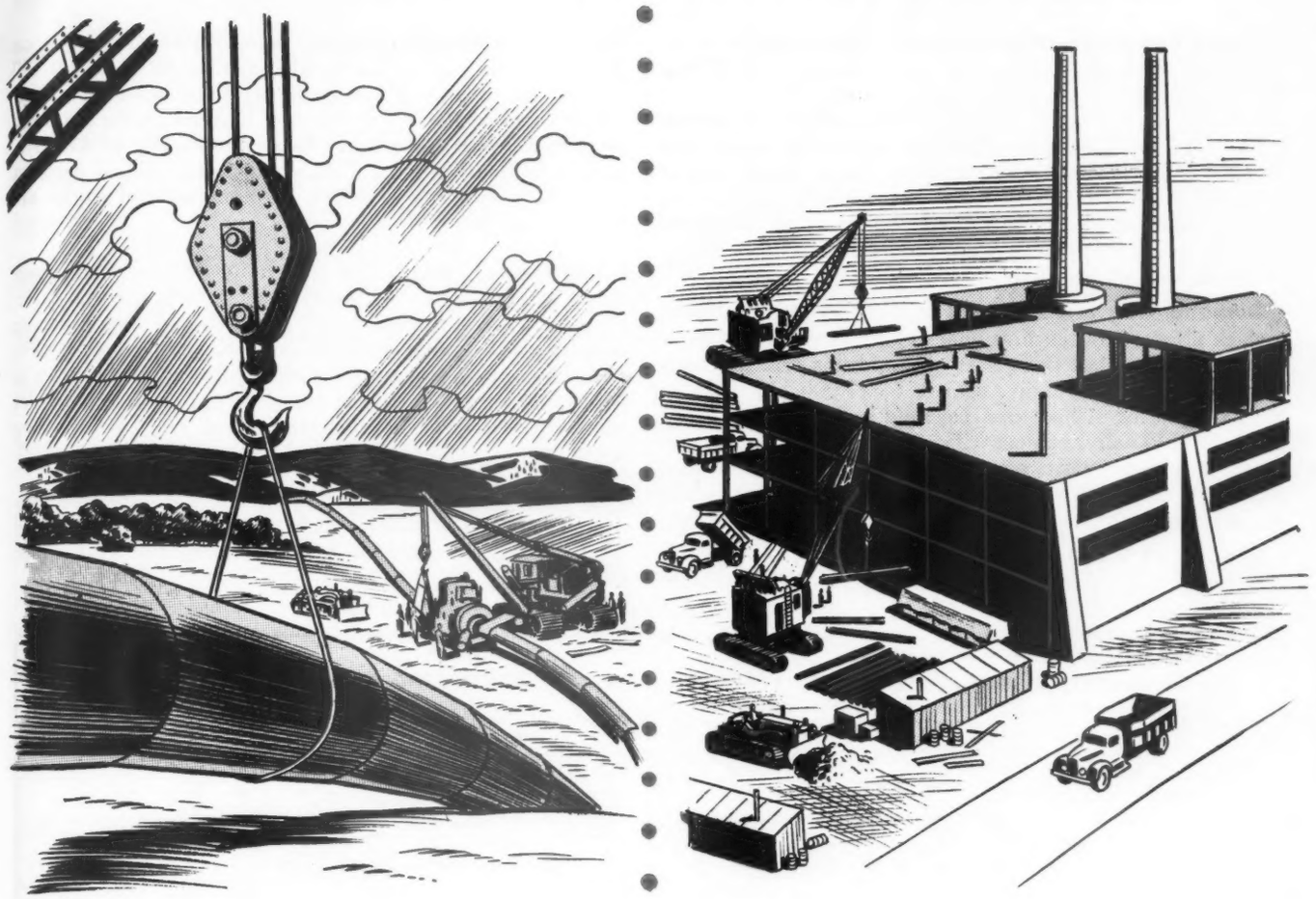
▸ **Divorcement.** The divorcement issue is getting less attention from independent jobbers now than a few months ago. One group, the National Oil Marketers Association, whose general counsel, Paul Hadlick, is credited with persuading Senator Gillette (Democrat, Iowa) to sponsor three divorcement bills, has apparently given up hopes for a hearing this year and is now concentrating on having the Department of Justice make a comprehensive investigation of oil prices, including what is holding crude prices up. Another group, the National Oil Jobbers Council, which has been studying divorcement, decided that the Gillette bills did not fit the situation. Now, the NOJC is pressing for a congressional investigation of economic concentration, generally.

▸ **War-Oil Needs.** Interior Secretary Krug, who insists his synthetic fuels program is "our only safe course" to self-sufficiency within the U. S., says "present productive capacity in the United States and other accessible supply areas is not believed to be adequate, should the Nation find itself engaged in a major conflict."

▸ **Tankers.** ECA is on the warpath against "excessive use of Panamanian-flag tankers (mostly American-owned) to haul cargoes financed with Marshall Plan funds. Even though yielding to congressional pressure for use of American-flag tankers on all primary, long-term movements, ECA has made it clear that it will restrict the employment of Panamanian-flag vessels.

▸ **Small Refiners.** Several independent refiners, awarded contracts to buy government royalty oil at premium prices, are urging the Senate Interior Affairs Committee to sponsor legislation eliminating the premium-payment clause from all such contracts. However, Interior Department, while sympathetic, may insist that such relief be limited to hardship cases among the small refiners awarded royalty oil under the O'Mahoney Law.

FROM PIPE LINES TO PAPER PLANTS



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National Petroleum Situation

Texas Promotes Improvement. Drastic cut-backs in Texas oil production during the last 3 months, which have reduced the State's output since December by about 382,000 bbl daily, have promoted marked improvement in the national oil supply situation. Despite imports of more than 600,000 bbl daily in March, national crude supply was at least 307,000 bbl below the level of January 1. As a result, the supply of all oils in the United States was cut to 6,430,000 bbl daily, which was a net reduction since December of about 338,000 bbl daily.

Demand Continues Upward. Demand for petroleum and its products in the first quarter of this year was about 4 per cent above last year. Total demand this year has been about 6,598,000 bbl daily, against 6,317,000 bbl daily in the first quarter of last year. Demand in March was about 6,963,000 bbl daily, against 6,234,000 bbl daily a year ago, or about 11 per cent greater. Fuel oil demand in the first quarter of this year was 5 per cent above last year, while demand for motor fuel increased 6 per cent over a year ago.

Stocks at High Level. Despite improvement in the national supply picture, stocks of all oils are 105,102,000 bbl above the levels of a year ago. Stocks of all oils on March 31 were 596,573,000 bbl, against 491,471,000 bbl a year ago. Stocks of crude oil represent about 48 days' supply, against 42 days a year ago. Refined products stocks, including natural gasoline, comprise a supply of 47 days, against 41 days last year. Fuel oil stocks are still 37 per cent above the level of a year ago, while motor fuel stocks are 18 per cent greater.

Exploration Brisk. The search for new oil fields continues at a brisk rate. Wildcat completions in the first quarter of this year totaled 1438, against 1274 last year, an increase of 13 per cent. California, Kansas, New Mexico, Louisiana, and Texas have reported substantial increases in wildcat operations this year. Development drilling is 10 per cent above last year, but new starts in all areas are running about 2 per cent behind a year ago.

Crude Price Cut. For the 5th time in 4 months, Pennsylvania crude prices were reduced, effective April 1. Bradford crude was cut 20 cents to $3.55, a reduction of $1.45 since December 11, 1948.

Comparative Statistics, March, 1949

*All figures are computed on a Bureau of Mines' Basis**

	Mar. 1949℗	Feb. 1949℗	Mar. 1948	This year to date	Last year to date	Per cent change
Total supply, all oils	199,348	181,896	194,537	583,167	565,509	+ 3
Daily average	6,430	6,496	6,275	6,458	6,214	
Total demand‡, all oils	215,852	193,759	193,262	593,896	574,838	+ 4
Daily average	6,963	6,920	6,234	6,598	6,317	
Change in stocks	—16,504	—11,863	+1,275	—10,279	—9,329	
Crude supply*	181,320	164,560	176,275	529,625	512,016	+ 3
Daily average	5,850	5,877	5,686	5,884	5,626	
Crude demand‡	175,345	158,835	173,530	516,079	508,551	+ 1
Daily average	5,656	5,673	5,600	5,734	5,588	
Crude stocks	269,800	263,825	234,164	269,800	234,164	+15
Days supply	48	46	42	48	42	
Natural gasoline production	13,200	12,355	12,268	38,855	35,609	+ 9
Daily average	426	441	395	431	391	
Motor fuel production	76,540	71,910	72,025	238,230	213,355	+12
Daily average	2,470	2,568	2,323	2,647	2,344	
Gasoline yield, per cent	41.2	42.4	37.9	41.9	38.7	+3.2
Motor fuel demand‡	72,122	64,548	70,784	204,575	192,630	+ 6
Daily average	2,327	2,304	2,283	2,273	2,117	
Motor fuel stocks	126,906	122,470	108,204	126,906	108,204	+18
Days supply	55	53	47	55	47	
Fuel oil production	66,800	62,915	73,071	201,895	216,446	— 7
Daily average	2,155	2,246	2,357	2,243	2,380	
Fuel oil demand‡	100,560	92,980	84,119	276,915	263,652	+ 5
Daily average	3,244	3,321	2,714	3,073	2,900	
Fuel oil stocks	100,900	127,460	74,159	100,900	74,159	+37
Days supply	31	39	26	31	22	
Refinery still runs	167,100	150,680	167,007	491,990	488,817	+ 1
Daily average	5,400	5,381	5,387	5,466	5,371	
All refined stocks	327,373	349,252	257,307	327,373	257,307	+27
Days supply	47	50	41	47	41	

Current Crude Oil Prices

U. S. Average	$2.55	Louisiana	$2.62
Texas	2.61	Arkansas	2.43
California	2.42	New Mexico	2.40
Oklahoma	2.63	Mississippi	2.42
Kansas	2.62	Illinois	2.76
		Other states	2.90

Basic crude prices:	
Oklahoma-Kansas (36 gr.)	$2.57
Texas Gulf Coast (36 gr.)	2.86
East Texas	2.65
West Texas (36 gr.)	2.44
California Signal Hill (26 gr.)	2.41
Pennsylvania, Bradford	3.55

Drilling and Production Statistics

	Mar. 1949℗	Feb. 1949℗	Mar. 1948	This year to date	Last year to date	Per cent change
Wells drilling	4,330	4,410	4,400	4,330	4,400	— 2
Total wells drilled	2,911	2,358	2,593	8,607	8,013	+ 7
Development wells	2,304	1,880	2,049	6,829	6,218	+10
Oil	1,557	1,309	1,488	4,708	4,457	+ 6
Gas	207	185	170	609	539	+13
Dry	540	386	391	1,512	1,222	+24
Per cent dry	23.4	20.4	19.1	22.1	19.7	+2.4
Service wells	103	104	159	340	521	—35
Wildcat wells	504	374	385	1,438	1,274	+13
Oil	98	57	55	236	177	+33
Gas	19	9	22	38	59	—36
Dry	387	308	308	1,164	1,038	+12
Per cent dry	77.0	82.4	80.0	81.0	81.5	—0.5
By States						
Wells drilled (excl service)	2,808	2,254	2,434	8,267	7,492	+10
Arkansas	28	23	15	55	78	—30
California	169	186	204	622	633	— 2
Illinois	133	166	126	483	453	+ 6
Kansas	226	197	164	658	605	+ 9
Louisiana	153	155	156	523	423	+23
Mississippi	30	21	28	80	95	—16
New Mexico	37	46	55	124	147	—16
Oklahoma	268	184	278	799	872	— 9
Texas	1,192	785	851	3,208	2,458	+31
Other states	572	491	557	1,715	1,728	— 1
Wildcats drilled (incl above)	504	374	385	1,438	1,274	+13
Arkansas	5	4	4	11	22	—50
California	41	37	20	131	71	+85
Illinois	20	19	23	73	84	—13
Kansas	42	28	22	114	87	+31
Louisiana	26	17	20	62	56	+11
Mississippi	12	3	10	27	25	+ 8
New Mexico	2	7	6	24	12	+100
Oklahoma	44	34	52	151	188	—20
Texas	269	164	167	667	538	+23
Other states	43	61	61	178	191	— 7
Daily crude production	5,204	5,404	5,406	5,364	5,347	+ 1
Arkansas	87	91	87	90	86	+ 5
California	951	943	940	947	935	+ 1
Illinois	174	175	174	177	173	+ 2
Kansas	301	281	273	274	282	— 3
Louisiana	517	533	480	524	475	+10
Mississippi	107	107	120	110	117	— 6
New Mexico	135	133	130	135	127	+ 6
Oklahoma	400	425	406	421	400	+ 5
Texas	2,170	1,365	2,431	2,297	2,400	— 5
Wyoming	130	130	143	132	140	— 6
Other states	232	221	222	257	212	—26

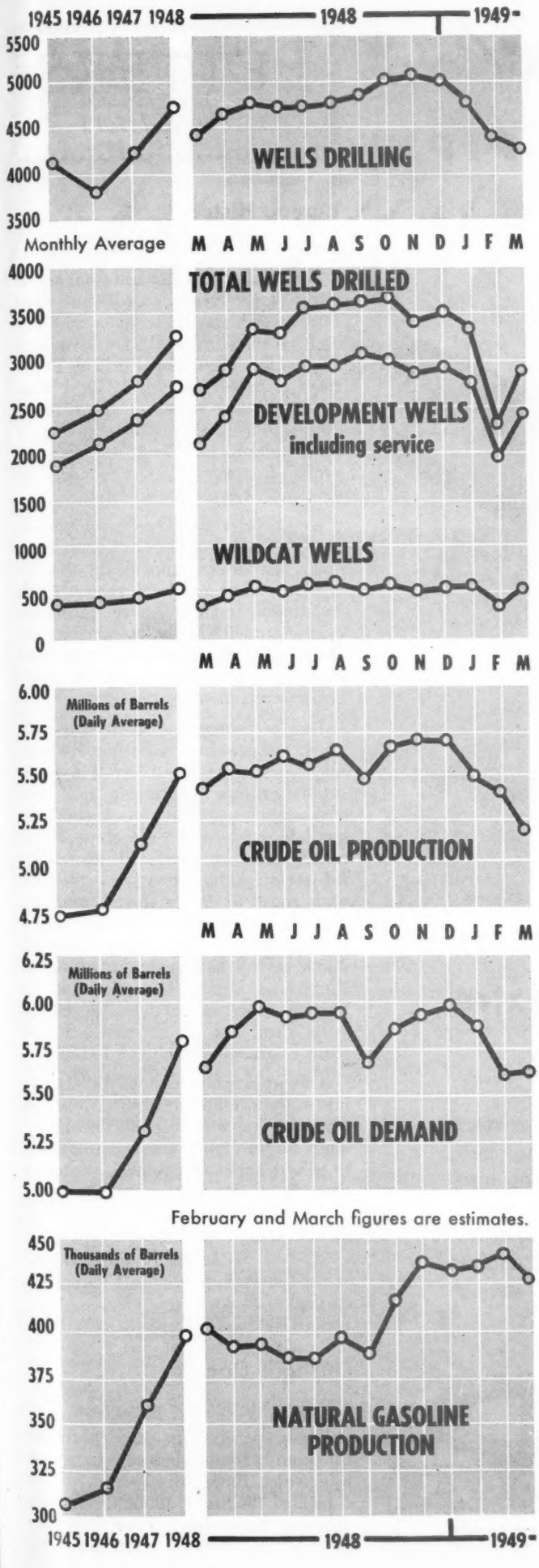
*Unless otherwise stated all figures represent thousands of barrels.

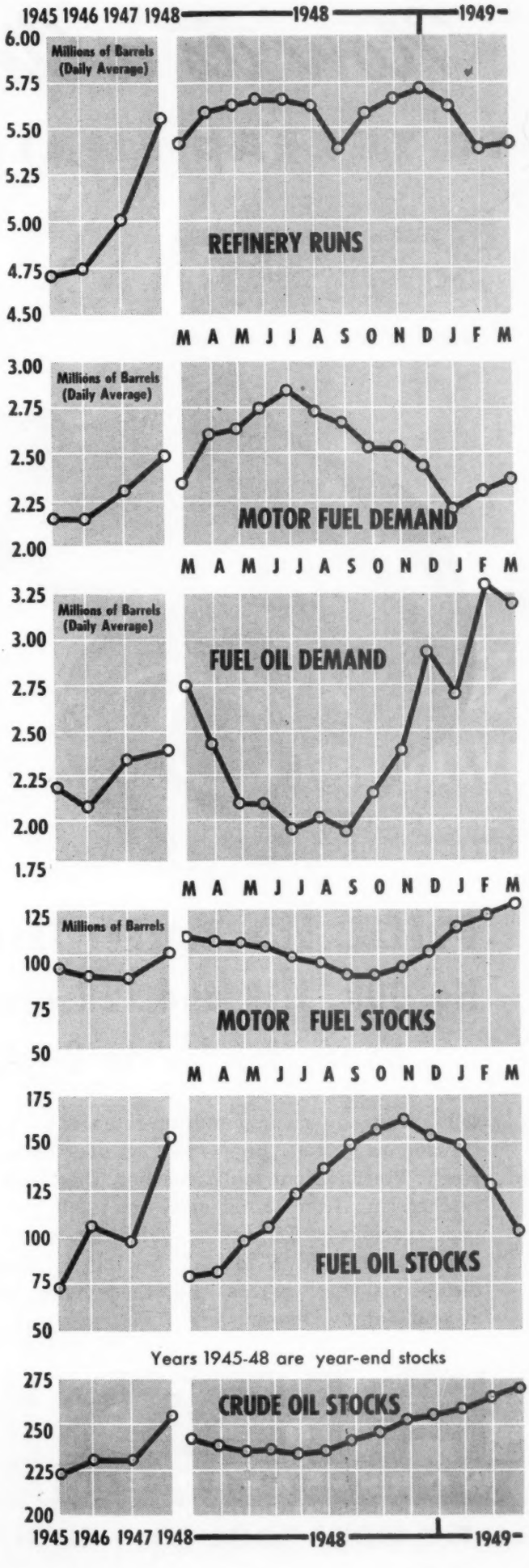
‡Total demand, including exports.

℗–Preliminary.

•Includes domestic production and imports.

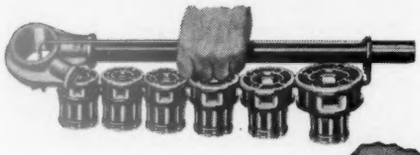
Preliminary estimates based upon data supplied by American Petroleum Institute, U. S. Bureau of Mines, State Agencies, and other official sources.


1945 1946 1947 1948
1948
1949
WELLS DRILLING
Monthly Average
M A M J J A S O N D J F M
TOTAL WELLS DRILLED
DEVELOPMENT WELLS
including service
WILDCAT WELLS
Millions of Barrels
(Daily Average)
CRUDE OIL PRODUCTION
CRUDE OIL DEMAND
February and March figures are estimates.
Thousands of Barrels
(Daily Average)
NATURAL GASOLINE
PRODUCTION


1945 1946 1947 1948
1948
1949
Millions of Barrels
(Daily Average)
REFINERY RUNS
M A M J J A S O N D J F M
MOTOR FUEL DEMAND
FUEL OIL DEMAND
MOTOR FUEL STOCKS
FUEL OIL STOCKS
Years 1945-48 are year-end stocks
CRUDE OIL STOCKS

Now it's a Cinch

TO THREAD SMALL PIPE



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LETTERS
to the Editors

Bureau History

To The Petroleum Engineer:

Now that the fourth and final article of the series "History and Analysis of Bureau of Mines' Petroleum and Natural Gas Division" by Ernestine Adams has been issued in The Petroleum Engineer, March 1949, I want to express my personal appreciation for the fine spirit in which this work was undertaken, and my highest praise for the effort expended by Ernestine Adams and the staff.

Ken Sclater and The Petroleum Engineer deserve credit for initiating a series of articles appraising the 36-year record of a federal agency. Such an attempt is all the more significant in these times when many persons are skeptical of the worth of government agencies and when the word "Bureau" bears an unsavory connotation.

I know something of the conscientious, painstaking, and time-consuming work performed by Ernestine Adams on this assignment, and I am envious of her ability to review, assimilate, and compose technical material in such an intelligible and colorful style. Although I was familiar with most of the material used by Ernestine I can say truthfully that I have enjoyed reading this series as much as if I had never heard of the Bureau of Mines. The same can be written about her article "Wyoming —Its Past and Its Promise," Petroleum Engineer, November 1948.

The principal value of this series lies in the evaluation of the Division's work by industry, which The Petroleum Engineer had the forthrightness to solicit and publish. We are happy that most of the comments were praiseworthy, but we are not unmindful of the constructive criticism.

Charles B. Carpenter,
Supervising Engineer,
Bureau of Mines,
Dallas, Texas.

Offshore Line

To The Petroleum Engineer:

Please accept my sincere thanks for your prompt delivery to me at Edgewater Park, Mississippi, of cut copies of the story about the Lavaca offshore lines, from your February issue ("New Methods Used in Laying

HERE'S NEW AND GREATER

Protection!

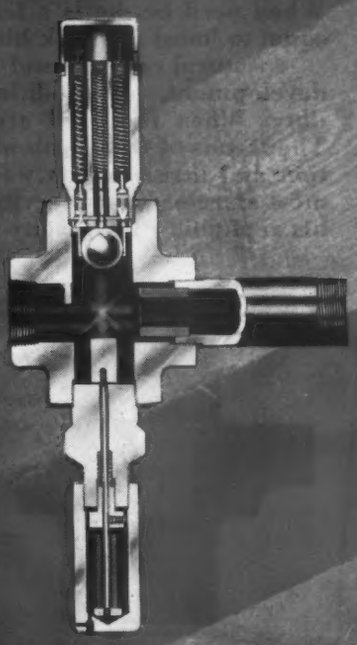
AGAINST

- EXCESSIVE PRESSURES . .
- FLOW LINE BREAKAGE . .
- STORM AND HURRICANE . .

FOR ALL PRODUCING WELLS

W·K·M Automatic SHUT-OFF VALVE

(Meynig Pattern—Patents Pending)



Automatically closing against any predetermined high or low pressure, the W-K-M Shut-Off Valve is a double-acting safety valve that reduces damage, danger and loss caused by flow line breakage to an absolute minimum; it protects flow lines and separators against excessive pressures; it further permits all wells flowing into one separation point to be closed simultaneously simply by closing one central control valve at the point of separation.

Designed originally for use on marine wells to provide safety and protection in event of line breakage caused by high pressure, dragging anchors, storms and hurricanes, the valve has proved highly successful on all producing wells . . . flowing, pumping or gas lift . . . whether they're on land or water. It is of especial value in areas where paraffin or ice threaten flow lines.

Light weight, low cost, easily installed on any well, the valve has opening and closing pressure ranges from 5 to 3000 p.s.i., to cover practically every producing condition.

For complete information, write for Bulletin No. 693.

W-K-M Company, Inc.

OIL FIELD, PIPE LINE & INDUSTRIAL EQUIPMENT

HOUSTON, TEXAS, U. S. A.
LOS ANGELES

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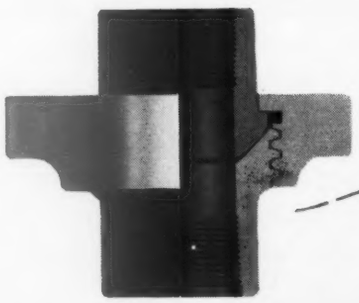
Export Office: 30 Rockefeller Plaza, New York, N. Y.

First, last and always a working dog, the German Shepherd is distinguished for dependability, and courage, and the ability to adapt himself to numerous services. Poised and unexcitable, he imparts a feeling of confidence to those whom he serves, whether he's guarding sheep, doing police work or serving as an eye for the blind.

Ordinarily, he's not an ill-tempered brawler, but woe be it to the man or animal who interferes with the discharge of his duties. When need be, he is a fearless fighter, with courage and physique equal to 'most any task his sense of duty prompts him to undertake.

Natural courage and intelligence, coupled with years of careful development, well conditioned the Shepherd for his most spectacular duty. When the need arose for war dogs, he received first call. Thousands of G.I.'s with whom he served relied upon him for protection and assistance. It was a well-placed reliance . . . even in this most extra-ordinary service, the German Shepherd kept untarnished his reputation for loyalty and dependability.

Through many years' service under varied conditions, WECO Unions likewise have established an outstanding record for dependability. They, too, have been carefully developed and proved for many duties. Wherever they are used, they stand as symbols of security . . . finest protection available anywhere. They're sold through all leading supply stores.



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Export Sales: CHIKSAN EXPORT COMPANY, Brea, Calif. New York 7

WECO
Manufacturers and Distributors of Oilfield, Refining, Marine and Industrial Equipment

Line Offshore," by Sammy Collins, Page D-5.)

I heard high compliments on this fine article from our men at Edgewater in our sales meeting, to whom I distributed a copy to each. It was especially interesting to me because I was present at the coating and launching operations, observing the handling of our pipe line enamel, and became acquainted with Sammy Collins. However I did not get out to see the actual offshore operations.

F. M. Hieronymus,
The Barrett Division,
Allied Chemical and Dye Corporation,
Tulsa, Oklahoma.

Likes Specialized Issues

To The Petroleum Engineer:

I think your new idea (of specialized publication) is really a step forward. It sure sounds swell—not to have to look through 40 or 50 articles and pages you care nothing about, to find one or two you want to read.

After 15 years as toolpusher and superintendent for Loffland Brothers Company, I left them in May and Mr. B. F. Allison and I formed the Allison & Hastings, Inc., with offices in Casper, Wyoming. We are operating four rotary rigs.

M. R. Hastings,
Basin, Wyoming.

Continuous Tables

To The Petroleum Engineer:

I visited with your representative in Tulsa at the Oil Show last May and approached him with regard to obtaining a complete set of The Petroleum Engineer's Continuous Tables. He offered the opinion that I could get them later on in the year.

Our organization here is composed of several engineers who are all subscribers to the magazine but none of us have access to the tables. We are sure that the material in the tables will greatly simplify our work and I shall be very much pleased if you will advise me where I can obtain at least one copy of same.

J. B. Flugstad,
District Manager,
The Texas Company,
Cut Bank, Montana.

Editor's Note: To Mr. Flugstad and a number of other engineers who have written in about the Continuous Tables this book is at present out of print. New tables are published each month in the E section of The Petroleum Engineer in such a way that they may be cut out and kept in notebook form.

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Take a look at the amazing performance records of International multi-cylinder engines on oil field pumping jobs. Then check *your* oil field pumping power. Are you getting results like this?

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WICHITA FALLS, TEXAS

December 29, 1948

Mr H R Carlson, Ass't Dist Mgr Industrial
International Harvester Company
1809 South Lamar Street
Dallas, Texas

Dear Mr Carlson

As you know we have been using International Power Units for the past six years We now have a total of sixty-one International engines in service, forty-nine of which are being used for oil well pumping purposes

We purchased our first International Power Unit in May, 1942, and this U-4 Power Unit was installed on the Griffin "D" Lease, Well No 3 on June 6, 1942 The depth of this well is 4,368 feet

The purpose of this letter is to tell you about the excellent motor performance we have had from this engine It is on a 24-hour operation, and since being installed, it has operated 56,232 hours, and to date the head or motor pan have never been removed The engine is still operating with the original main and connecting rod bearings, sleeves, pistons and valves The valve tappets were adjusted once during these 6-1/2 years operation We feel this is a splendid record for your engine

We also have a U-6 on the Daume Lease, Well B-1, that has 26,280 hours of operation to date, and the head or pan have never been removed We are hopeful that the balance of our International Power Units will perform as well

You will be interested to know that we are using your U-6 International engine on some new production we have and if our original plans are carried out we will standardize on this engine in that field

We are interested in dependable power and operating at a low cost We believe you have that in your International Power Units and your International Trucks which we also use

You can readily appreciate why we are International Power minded

Very truly yours,
G. E. KADANE & SONS
Mike Kadane
Mike Kadane

MK jk

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INTERNATIONAL INDUSTRIAL POWER

PETROLIC PERSONALITIES

DICK SNEDDON

That much traveled gentleman, Paul Daniel of the Daniel Orifice Fittings Company, is off on another of his sporadic dashes into petrolic space. He has already visited Alaska, Siberia, the Philippines, Europe, and endless other principalities, republics, and just plain places, but by some strange lapse has never loitered in Lima or supped with the Sao Paulans. However, all that is about to be rectified for, in company with June—his much better half—he will shortly be jet propelled into the Mid Continent where he will consult and consort with his dealers and distributors. Thence he will wend his way to New Orleans, and on April 29 will board the Alcoa liner *Cavalier* for Caracas. Arrived there he will no doubt park his grips at the Avila Hotel and immediately proceed to shoot up the town—with his camera, in color.

From there he will ramble on to Rio, Buenos Aires, Trinidad, Sao Paula, Lima, etcetra. After a brief stay in etcetra he will return to the San Gabriel Country Club out California way and continue to lash the sward with that rare viciousness for which he has long been noted. Paul is a really top oil golfer; has a hole-in-one to his credit; and has an excellent library of Kodachrome shots of his own making, including series on Alaska, the Swiss Alps, the Sigfreid Line, and prewar London. He began his oil career with E. L. Doheny in the old Pan Am days and has been at it for 33 years; is a long time Nomad; a pioneer of the California Natural Gasoline Association; and besides is mighty nice people. The Daniels will be joined in Caracas by Bill Griffen, general sales manager of the Company, who will fly there to meet them.

From Chicago comes word that Joe Donnelly, prexy of the Donnelly Process Corporation, is now lolling in the deep, luscious climate of San Diego, California, and drinking in great drafts of almost pure ozone. He is determined, at least so we are told, to return home so thoroughly tanned and so generally saturated with the sunshine vitamines that he will be able to withstand, ad infinitum and from there on, every vicissitude of the Windy City. It's a good idea, too. We have heard that this Illinois village is very damp—on account it is situated at the bottom of Lake Michigan. Must be dark down there also!

Anyway, in his 40 years around the petrolic loop, Joe has made a raft of friends in the industry, all of whom are currently glad to learn that he is enjoying a bit of well earned relaxation in such a nice environment: and the San Diegans, of course, are similarly gratified to be honored with such an august presence. There is some possibility that the illustrious Chicagoan may route his return via Dallas, so that he may trade hellos with his old friend, Arch Foster.

Another Illinoisian of whom we hear good tidings is Art Smith, vice president of the Jenkins Petroleum Process Company, Chicago, who is but recently returned, with a new exhuberance, from an extended trip through Illinois and Oklahoma. On this jaunt he visited and counselled with a great many licensees of the Jenkins' processes and enjoyed the entire experience no end. Art is not only a petroleum technologist of the highest repute, but is also a patent attorney who knows more about the intricacies of manufacturing processes and arts than does the daddy of all the inventors, that well known Irishman—old Pat Panding himself. In consequence, when he tours the catalytic circuit on such barnstorming tours, he is usually busier than a dirndl skirt in a cyclone. But he seems to like it, because he does it agayne, and agayne, and agayne.

By the way, it perhaps has nothing to do with the subject, but this might be a good spot to make it known that we have almost completed an interesting invention of our own. It's a salt shaker with a solid top for use by oilmen who don't like salt in their beer.

We were listening intently the other evening to the confident carolling of a snug group of Nineteeners out at the Wilshire Country Club in Los Angeles. They were being led—into strange pastures, goodness knows—by the ear splitting tenor of Ward "One-T" Blodget, the wildest Wildcat of them all. The regular performers were distinctly recognizable in what might be roughly called "the ensemble," but our keen musical ear caught the unmistakable pulsing of a new tremolo. The piece that was being hurled defiantly at the welkin just then was, "There's a Girl in the Heart of Maryland," and when we crept in close to check up on the strange voice, there standing in the middle of the a capella choir, singing with deep emotion, was Maryland's favorite son, C. R. "Reds" Zimmerman, executive vice president of Bethlehem Supply Company, from Tulsa, Oklahoma.

Reds was born in Baltimore, and he joined in this tribute to his native state with a rare fervor. Of course, the quaver in his voice could have been the result of pity for the other singers, we are not in a position to debate that point, but it did sound to us like a plain old attack of nostalgia. Incidentally, that plural nickname seems odd, although it is quite rational when you know how it came about. Actually the s is just a carryover from the surname. Repeat "Red Zimmerman" a time or two, and note how the z naturally adheres to the d. Isn't that interesting?

There was great consternation in the normally placid village of Santa Maria, California, last Washington's birthday, when it was bruited about locally that W. E. Earl Gillfillian, supervisor of pipe lines for Tide Water Associated, had beaten all prior records, and had turned in a scintillating 31 for the first hole at the Santa Maria Golf Club, which is definitely one of the most amazing divot lofting performances ever chronicled. The citizenry were all agog, but Earl himself is quite modest about the whole thing and frankly admits that in previous assaults on this same hole he has never been able to get more than 20. As a memento of the amazing event, there is talk of presenting him with a new type golf bag that features a built-in abacus, and we have had one or two overtures from Bob "Believe It Or Not" Ripley for the sordid details, but we are not giving out. In the meantime, the Santa Maria golf course is being quietly returfed, and we have been promised an exclusive should there be any further repercussions.

Incidentally, we toddled up to Ventura recently to visit at the world's deepest well as a guest of Vice Presidents Bill Keck Jr., John C. Cody, and Bob Allan, of Superior Oil Company, and they really showed us a grand time besides giving out generously with the hop on the Limoneira well.

View of Oceco 3" Screwed Connection Vent Valve with Flame Snuffer and Chain.

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V-113 VENT VALVES

for maximum efficiency, economy and dependability

View of Oceco 6" Flanged Connection Vent Valve showing mounting on Oceco Flame Arrestor.

● Oceco Vent Valves provide positive and dependable control of tank breathing. They prevent the free discharge of vaporized liquids resulting from fluctuations in temperature,—and restrict tank breathing, resulting from pumping into a tank. They avoid any serious lowering of gravity ratings;—retard the formation of gum;—and avoid "cave-ins" and "blow-outs" resulting from excessive vacuum and pressure.

These valves combine the advantage of our twenty five years of experience in meeting the industry's most exacting requirements;—and the results of exhaustive tests conducted in our laboratories. The Venturi effect of the body gives the valves even greater pressure capacity than an open nipple, while the spacing and design of the openings provides large vacuum relief. The drip edges on the valves carry away any condensate, thus protecting the valves against corrosion and freezing, and the stem guided construction prevents sticking and "cocking."

The housings are semi-steel castings that can withstand direct exposure to flames for long periods of time, and consequently provide a solid support for the valves, valve guides and seats, keeping them in proper alignment and assuring tight closure at all times.

Furnished in 2" and 3" sizes for screw mounting, and 4", 6", 8", 10" and 12" sizes for flange mounting, either as individual units or complete with an Oceco Flame Arrestor. Prices and a fully descriptive bulletin sent promptly on request.

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PETROLIC PERSONALITIES

During lunch at the Ojai Inn we learned that Lew Rogers, petroleum engineer in charge of the deep well, has a pretty rugged time with his telephone calls. The trouble is that the company has on its staff another petroleum engineer, a Chinese lad, named John Lew, and when insurance salesmen ask on the phone for Lew, they are not unlikely to get one Lew in lieu of the other Lew, if you get the idea. 'S a pretty difficult situation and actually we can see no recourse but to turn the whole business over to the U.N. However, we did want to say in the meantime that the trip and all that went with it was a right nice experience, for which we are duly grateful to all the Superior people who hosted the event so graciously.

Our Palm Springs correspondent tells us that he has noted among the important people sunning in the desert air down thataway, John Crawford, chairman of the board of Parkersburg Rig and Reel Company, Parkersburg, West Virginia; member of the Petroleum Production Pioneers, and a gentleman who fits nicely into any respectable convocation of petroleum people. We also hear that while on the west coast he seized the opportunity to visit an old friend, R. A. "Broomie" Broomfield, the Barnsdall Oil Company Luther Burbank. Broomie grows orchids of infinite variety and wonderful beauty; has 800 feet of the most persistent climbing roses that ever clumb; and a great profusion of flowers with a great confusion of names, growing all about his Tarzana rancho.

Daily he takes a load of fresh blossoms down to the Barnsdall office in the Petroleum Building, Los Angeles, and there isn't a girl in the place who doesn't watch for him with the peculiar eagerness all the bobby soxers of all the ages have reserved for the Frankie Sinatras of their day. As a matter of fact, in order to keep from being totally enveloped in this mantle of adulation, Broomie finds it advisable to hie off into the woods occasionally and find a quiet stream where unnoticed he can do an altogether different type of angling.

A *lad who shall* be nameless tells us that he was tailing out rods as a freshman roustabout for Shell in the Earlsboro district some 18 years ago, when who should drive up to the rig with a nice, big, new, heavy rod wrench but Holt McWorkman, now assistant sales manager of S. M. Jones, Tulsa, Oklahoma. This wrench, Holt proclaimed, would make and break connections better than the light wrenches then in use, because of a loose snap near the mouth. The boys were obviously skeptical, but Holt gave the wrencher a demonstration anyway and then walked away leaving the heavy wrench on the derrick floor.

After he had gone the wrench was given the old heave-ho and a thick barrage of wisecracks. But, about a week later, another wrencher, just out of curiosity, gave it a trial and decided that he liked it. Then, one by one all the men tried it and liked it and they agreed that even if it was heavier it was easier to handle. Thereafter, the despised and rejected became standard equipment. Shore hard to teach an old dog new tricks!

Recently back to the United States from Qatar is Bill "Spice" Spicer, erstwhile driller for Iraq Petroleum Company, and a cosmopolitan of some years standing. Spice has sought what Major Burnham always called "the oof bird" in Canada, Mexico, the Middle East, and sundry other bailiwicks. He has even gone into an occasional stud game in the hope of building up a sustaining stake for his old age, but has found that poker is just a game in which a group of lads are striving to get nothing for something. While over there in the cool of the Persian Gulf, he officiated as chairman of the Qatar Club, of which the membership is some 99.9% British. Spice really enjoyed his association with the English chaps, made a lot of friends among them, and now speaks with a pronounced don't you know and all that sort of bally rot.

He expects to take off into foreign parts again come the middle of May, but at the moment is not quite decided in what direction he will set his steering gear. When at home for any length of time he has a faculty for becoming embroiled in civics and stuff, was, indeed, formerly president of the Chamber of Commerce at Dominguez, where Major Burnham finally found his oof bird. "Oof," in case you don't know is the English equivalent of our "mazuma."

Another recent visitor from the land of the Thousand and One Nights is Jack Walsh, also a driller for Iraq Petroleum Company, lately resident in Basrah, and before that for two years in Tripoli with Lebanon Petroleum Company, a subsidiary of IPC. Jack expects to go back to Tripoli about April 31, but is not quite sure what his final destination may be until he has cleared with the New York office. Meantime, he had hoped to crowd in a bit of fishing and hunting here but is a bit pessimistic about it now, on account of time and tide won't wait for nobody, and there are more things to be done and people to see "than are dreamt of in all our philosophy." However, like Spice, he too enjoys hunting for combinations that pay off in poker games, so maybe he won't be completely denied a profitable vacation.

Jack tells us, by the way, that the climate of Tripoli is excellent without the aid of a chamber of commerce, and that fruits, vegetables, and flowers abound. Their most delicious fruit is the grapple, which is a cross between an apple and a grape. Unfortunately it is very rare so Jack has never seen one and couldn't tell whether it was half the size of an apple or half the size of a grape. Oh, well, science is boring stuff anyway!

Hobart La Mar has returned from a session in Karachi, where he was drilling superintendent in charge of the Lakhra district for the Burma Oil Company. Here is one world traveler who has prowled around foreign parts almost continuously for the past 25 years and never seems to tire of it. He has drilled in eight countries besides the United States, to wit: Persia, Colombia, Venezuela, Mexico, Trinidad, New Zealand, Pakistan, and last in Burma. He is a brother of Charlie La Mar, toolpusher with the Iraq Petroleum Company, now working in the Mosul field.

The La Mar boys were born in Lincoln City, Indiana; are associate members of Nomads, and lead the sort of life that would entitle them to be called nomads even if they didn't belong to any association. They are freelance workers who follow the fortunes of the foreign fields, working their heads off in far distant lands until they feel that they have earned a brief rest, and have also developed an irresistible yen to go home. Then they return to the United States, unlock their flintlocks; sharpen their fishhooks, and forthwith stalk a moose or two, do a bit of duck hunting, or trout fishing. Having stocked the deep freezers of a few close friends, they promptly board their flying carpets, put on their dark glasses, and are whisked away again to some distant domain. It's the way we have always wanted to live, but, doggone it, we never learned to drill oil wells, so we don't seem to be much in demand in foreign parts.

THE Petroleum Engineer

APRIL
1949

Count on Oil for the Years Ahead!

Brilliant exploration and production records of the petroleum industry confound dire prophecies of experts who "foresaw" oil's vanishing point just around the corner.

It is a quirk of human nature that we like to find the experts wrong. For many, disappointment over last November's election results was lessened by pleasure over the abysmal forecasting failure of the political and public opinion experts. Of course, those who liked the returns had occasion for increased rejoicing.

But when it comes to being wrong, probably no group of experts has missed the mark more consistently than the forecasters who have predicted America's finish as an oil producing nation. The story of American oil is replete with mortified prognosticators and humbled visionaries who thought they could foresee the day when this country's crude oil resources would become exhausted and disappear.

Reflection upon the mistaken warnings of these prophets of doom is particularly appropriate as the year 1949 commences. It is the ninetieth anniversary of the flow of oil from the Drake Well at Titusville, Pennsylvania, an event which marked the beginning of the American oil industry. In every decade of that 90-year period there have been Cassandras who croaked dismal warnings that the end of oil supplies was imminent.

Yet in the year just ended all American oil production records have been broken and the petroleum industry demonstrated — as it has done many times before—that it is capable of meeting the needs of the American people, whatever they may be.

Moreover, fresh evidence of the vitality of the American oil resource has just come to hand in the form of a report from an American Petroleum Institute Committee of which L. F. McCollum, president of Continental Oil Company, was chairman and Sun's president, Robert G. Dunlop, a member. Resulting from a study into the "Long-term Availability of Petroleum," this report states that during the next ten years "petroleum liquids from natural sources will be available within the United States in substantially increasing amounts."

In fact, the Committee foresaw the possibility of domestic crude oil production during the next five years increasing by substantially more than 1,000,000 bbl a day. This would mean a daily rate of 6,770,000 bbl a day in 1953. Adding to this crude oil total domestic natural gas liquids, the Committee estimated for 1953 an available domestic supply of 7,320,000 bbl a day of "natural liquid hydrocarbons," the most recently adopted term for the industry's raw material.

Acknowledgment

Because forecasts of oil production and estimates of petroleum reserves hold such a vital place in the formation of government and business policies of the nation, we reprint here in its entirety a significant and convincing article from the Winter Number, 1949, of *Our Sun*, published by the Sun Oil Company, Philadelphia, Pennsylvania.

The review of past prophecies should have a soothing effect upon many worried pessimists.

More Oil Available From Other Areas

In addition to this domestic production, the McCollum Committee called attention to the prospect of "increasing amounts of petroleum readily available from other areas in both the Western and Eastern Hemispheres for importation into the United States if needed," and also to the possibility of synthetic production.

The Committee estimated that crude oil production in the Western Hemisphere, outside of the United States, would increase from 1,750,000 bbl a day last year to 2,490,000 bbl a day in 1953 and that Eastern Hemisphere production, excluding Russia, would increase from 1,500,000 to 2,520,000 bbl a day in the same period. In other words, it is estimated that foreign crude oil production, excluding Russia, could be increased from 3,250,000 to 5,010,000 bbl a day in the next five years.

This increase in total foreign production, the Committee suggested, "should increase the availability from these sources for consumption in the United States." No effort was made, however, to estimate the distribution of this foreign oil. Increased production in the Eastern Hemisphere, it was pointed out, would supplant supplies now going to European and Asiatic countries from the United States and other Western Hemisphere nations.

"To the extent that this may occur," the Committee asserted, "it will obviously increase the availability of Western Hemisphere oil for use in the United States and other Western Hemisphere nations."

Attention was called to the proved domestic natural gas reserve of 166 trillion cubic feet at the beginning of last year. The Committee pointed out that in addition to being available as a direct substitute for heating oils, this natural gas was available for synthesizing into petroleum products along with shale and coal.

"Major Source of Energy"

Summarizing its report, the McCollum Committee held its findings indicated that "this nation can continue to grow through the use of petroleum products as a major source of energy."

In arriving at that conclusion the Committee assumed that the following basic conditions would prevail over the next 10 years:

"There will be favorable economic conditions.

"There will be no government regulation of, or restrictions upon, the industry's normal activities.

"Adequate materials will be available to carry on the industry's contemplated operations.

"Estimated availability will be based on maximum rates of production under engineering principles consonant with good conservation practices.

"There will be no serious interruptions in the industry's activities in the event of war."

McCollum and his associates pointed out that "any substantial deviation from these conditions in actual developments during the 10-year period, due to matters outside the control of the industry, necessarily would require modification of the forecasted availabilities."

Barring "any substantial deviation from these conditions," the McCollum report may prove to be a very conservative forecast of the next five years. At least, that has been proved by events in regard to similar reports previously issued by industry committees.

As recently as July, 1947, several very well qualified oil men publicly predicted that American daily crude oil production would not go above 5,300,000 bbl a day until 1951. It was at the time approximately 5,100,000 bbl a day. Within 18 months after that prediction, domestic oil production exceeded 5,600,000 bbl a day.

Crude oil production reached this figure because of the demand for petroleum products and a price which generated profits sufficiently large to provide incentives, and also funds, for the maintenance and expansion of production facilities. Had a ceiling been placed on oil prices or heavy taxation on profits back in 1947, last year's production records never could have been achieved. Instead of supply and demand being approximately in balance, as they now are, both gasoline and fuel oils undoubtedly would be rationed, with the consuming public's needs going unfilled.

Neither the McCollum Committee nor anyone else, in these unsettled times, can forecast what the future demand may be, for that will be affected by the economic and political temperature. But the Committee has given assurances that the domestic *supply* of oil will be available over the next five years to meet an increasing demand averaging five per cent annually.

Beyond that period it declined specifically to go. The Committee asserted, however, that "from the best data now obtainable no significant decline from the 1953 estimated rates is anticipated during the following five years, but it is impossible to foresee definitely at this time the probable trends."

The McCollum Committee did not concern itself with proved reserve figures. These are competently estimated each year by the American Petroleum Institute Committee on Petroleum Reserves under the chairmanship of Sun Oil Company's Geologic Consultant, Dr. Frederick H. Lahee.

New Oil Reserves Report Coming Soon

Reserve figures for last year will not be available until February or March. The Committee's latest estimate for the end of 1947 placed crude oil reserves at 21,487,685,000 bbl and natural gas liquid reserves at 3,253,975,000 bbl. This makes a total of 24,741,660,000 bbl of proved liquid hydrocarbon reserves, an increase of 704,881,000 bbl during 1947.

Prior to 1946 the Lahee Committee computed figures only for proved reserves of crude oil. In the thirteen years for which crude oil reserves have been surveyed, they increased each year over the preceding 12 months in every period except one. The exception was 1943 when heavy withdrawals of oil for war purposes left a deficiency for the year of 18,641,000 bbl or less than one-tenth of one per cent of the estimated proved reserve at the beginning of that year.

Since that year this slight deficiency has been made up 80 fold. The increase in crude oil reserves between January 1, 1944 and December 31, 1947 has been in the neighborhood of 1,400,000,000 bbl—and this during a period when annual production of crude oil was breaking all records by advancing from 1,678,421,000 bbl in 1944 to 1,850,445,000 bbl in 1947.

Despite this amazing record of crude oil production the country has been led to believe that the United

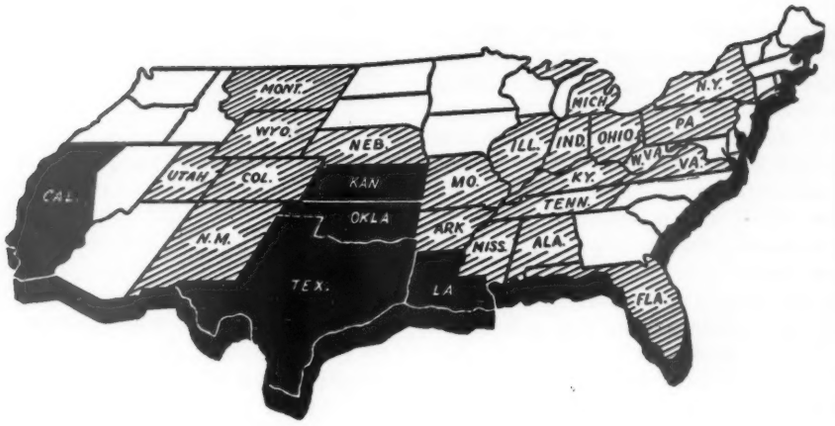
Consolation

To the Gloomy Guses who predict freely that present business is headed for the rocks because supply will soon satiate demand here is a bit of factual information to include in the equation before you can be sure it is solved:

Since the end of the war more than one-fourth of all finished steel production in the United States has gone into the manufacture of automobiles, diesel locomotives, tractors, and oil burners. All these products require fuel from the petroleum industry for their operation.

IN 1907—

Sixteen states were oil producers, with New York, Pennsylvania, West Virginia, Ohio and California accounting for 80 per cent of all oil produced up to that time. Other states, which became still heavier producers, were far underrated.



IN 1949—

Shows how the oil map of the United States has changed drastically. Now there are 26 oil producing states, with Texas, California, Louisiana, Oklahoma and Kansas the leaders. In coming years the map may change again.

States is "running out of oil"—that the country has domestic supplies sufficient for only 12 years at current rates of consumption. Such was the theme song of Harold L. Ickes during the years he was Secretary of Interior and Petroleum Administrator for War. The same tune was sounded a year ago by Secretary of Interior Krug and several members of Congress. The latter contentions were used to bolster proposals for a multi-billion dollar synthetics program. Some oil men, significantly interested in the development of foreign fields, joined that chorus. Although the singers were new on the stage, their refrain was almost as old as the 90 year oil industry itself.

We need go back, however, only to the turn of this century to find how wrong the oil "experts" have been in their forecasts that a latent weakness in the domestic petroleum resource had become apparent and that the end definitely was in sight. In the 40 years that preceded the Twentieth Century, crude oil production totaled approximately 1,000,000,000 bbl—an amount about equal to the American production in the last six months of 1948. Annual production in the last five years of the Nineteenth Century averaged 59,598,000 bbl.

Seven years before the century ended, Henry Ford produced his two-miles-per-hour automobile. It was not until 1900, however, that even the most observant realized a catastrophic event had occurred, destined to revolutionize existing standards of living. Here was the beginning of the test of the availability of our petroleum resources to serve the Nation, for petroleum was essential to the widespread use of the automobile.

As a matter of fact, it was not until the second decade of the Twentieth Century that people generally were convinced the horseless carriage was here to stay. Nevertheless, when in 1900 the number of automobiles had grown to 8000, some in that infant, but rapidly growing, industry questioned whether the production of gasoline could keep pace with the prospects for their mounting output.

The Flow of Oil Swells

In the face of such doubting the Spindletop Field in Texas (which played so important a part in the development of Sun Oil Company) gushed in as the biggest oil find up to that time, 1901; followed by Red Fork in Oklahoma Indian Territory, Sour Lake and Humble in Texas, and in 1905 by the Glenn Pool in Oklahoma. In the five-year period embracing 1901-1905, the annual production of crude oil averaged 102,083,000 bbl, or almost twice the annual average for the previous five-year period.

In 1905 there were 77,400 passenger automobiles, and 1400 motor trucks registered—a tenfold increase over 1900. At that time a 42-gal bbl of crude yielded about 4.3 gal of gasoline. Today that yield can be more than five times greater. In 1905 a sharp decline in price indicated that total United States petroleum production was in excess of the country's consuming capacity.

So it has been from that time forward, without exception—just as the thought grew that our oil resources could not satisfy for long the national need, excess supply has followed upon the heels of apparent, brief shortage. Price and demand have been the regulators of supply. So often has this happened that it demonstrates beyond doubt that the reason for any brief period of shortage is not any latent weakness in the resource but is to be found in other factors.

The first systematic attempt to measure the American oil resource was made in 1908 by David T. Day,

of the United States Geological Survey. Day compiled two estimates of the "total yield of the petroleum fields of the United States":

1. A minimum, which he figured at 10,000,000,000 bbl;

2. A maximum, which he put at 24,500,000,000 bbl.

The text accompanying this compilation indicated that Day did not intend to be held closely to these figures, but wished a leeway of approximately 15 per cent. His standing geologists of the productive capacity of known oil fields based upon known factors of porosity of sands and past yields.

In studying petroleum production figures, Day discovered that "beginning with 1860 as much petroleum has been produced in each nine years as the entire production preceding this nine years." Projecting this rate of increase into the future, Day estimated that in 1934 accumulated production would total 14,400,000,000 bbl and "nine years more, 1943, would bring the total to almost a maximum amount estimated as obtainable from the present fields." He doubted, however, a continuance of this rate of increase, chiefly because he did not believe the resource would permit it.

Strangly enough, Day's rule-of-thumb projection of production, despite his doubts, proved out amazingly accurate. Since 1907 the rate of increased production in each nine year bracket has not been precisely equal to the total previous production, but over the 36 years following 1907 it has averaged out at about this equivalent, as shown in next column.

Year	Day's estimate possible accumulated prod.† (In thousands of bbls)	Actual accumulated production‡ (In thousands of bbls)
1907..	1,800,000	1,807,000
1916..	3,600,000	3,917,328
1925..	7,200,000	8,669,672
1934..	14,400,000	16,598,444
1943..	28,800,000	28,098,467

†"Petroleum Resources of U. S.," U. S. Geological Survey Bulletin 394.
‡"Bureau of Mines" Report.

Although Day's projection of the past rate of increase in production approximated what has happened, he was far short of the mark in estimating resources. Instead of virtually complete depletion of resources, on his most optimistic basis, United States production in 1943 reached a new top of 1,503,000,000 bbl with an "Estimated Proved Reserves" of 20,064,000,000 bbl, or almost as much as Day variously estimated our maximum petroleum resources 36 years previously.

In fairness to Day, it should be noted he limited his prognostication to estimated yields obtainable from then "present fields." It is significant that his list of oil producing States totaled 17, whereas the tabulation of the American Petroleum Institute's Reserves Committee for 1947 listed 25 oil-producing States.

Potential Oil Resources Were Underrated

But Day erred grievously regarding the potential oil resources of the States which he listed. For instance, he forecast an ultimate total future production in California of 5,000,000,000 bbl or about one-half the production there since 1907 plus the most recent estimated proved reserve.

Day made a much greater margin of error in regard to Texas and Louisiana. He put down the Gulf Area resources as ranging from 250,000,000 to 1,000,000,000 bbl. Last year alone the Texas-Louisiana production was equal to the maximum figure which Day in 1908 estimated as the total resource of the two States. Between Day's estimate and 1948 the two States had yielded almost 10,000,000,000 bbl of crude—and the proved reserves of the two States at the beginning of 1948 were estimated at more than 13,000,000,000 bbl.

In other words, about 11 times as much oil has been taken out of Louisiana and Texas as Day estimated as their maximum resources, and, there remain in those two States more than 13 times as much developed, known oil as Day estimated was present there in 1908. Thus oil discoveries in Texas and Louisiana have been approximately 24 times greater than Day's most optimistic estimate.

Though Day was far short in estimating our potential oil resources, he should be judged within the framework of the knowledge that the industry possessed and the limited development of the geologic science in regard to petroleum in 1908. Some of his disciples in the under-estimating of oil resources cannot plead the same excuse.

Shockingly less than Day's most pessimistic estimates was a forecast made in 1915 by Dr. Ralph Arnold, who placed the original supply of oil at 9,098,551,000 bbl of which he believed 5,763,100,000 bbl remained in the ground at the end of 1914.

So the U. S. Geological Survey undertook a revision of the Day report, as of the end of 1915, publishing the results in February 1916. The Geological Survey estimated the petroleum remaining in the earth at 7,629,000,000 bbl, or 2,371,000,000 bbl less than Day's minimum figure. Ignoring Day's maximum figure, the Geological Survey added approximately 1,000,000,000 bbl to his minimum estimate and deducated 3,335,000,000 bbl as the total amount already extracted.

This 1915 estimate took into account "the productive possibilities, not only of fields already demonstrated to contain oil, but also of untested areas in which the geological evidence is promising." The Survey's report pointed to the possibility that perhaps 75,000,000 bbl or more of oil might be found outside of the major fields then known and contended that the "possibilities of finding oil in Oegon, North Dakota, South Dakota and in the Coastal regions of the Middle and South Atlantic States, which have not been included in the above estimates, should not be overlooked."

Commenting upon this finding, Mark L. Requa, then a consulting engineer of the Bureau of Mines, and later to become General Director of the Oil Division of the United States Fuel Administration — Ickes' World War I counterpart—in a report to the Senate in March, 1916, declared:

"It is doubtful if sources of supply, now unknown, can be developed in the United States *to compensate over any lond period of time for the decline of known fields."*

"It is highly improbable, in fact, that a quantity equal to the present Estimated Reserves can ever be developed in territory yet to be discovered."

Requa concluded his observations by stating:

"In the exhaustion of its oil lands, and with no assured sources of domestic supply in sight, the United

☆ ☆ ☆

Refinery—Weather Station

In Augusta, Kansas, the refinery of the Socony-Vacuum Oil Company, Inc., fills the unusual role of also being the area's principal source of weather information. Not only townspeople, farmers, and business firms depend on the refinery for this information—but the United States Weather Bureau at Wichita leans heavily on the refinery.

It all began about 26 years ago when the refinery superintendent began to keep records of his own, principally of rainfall, in order to anticipate flood conditions in the nearby Walnut River. Floods at that time were frequent and severe enough to interrupt the refinery's normal operations.

At present, the corrosion department is using the temperature records to correlate the change in electrolytic action of magnesium electrodes used for corrosion protection. Another use of the temperature records has been in setting up volatility specifications for gasoline manufacture. Many other uses of the weather record are made.

States is confronted with a national crisis of the first magnitude . . .

"*We must either plan for the future or we must pass into a condition of commercial vassalage,* in time of peace relying upon some foreign country for the petroleum wherewith to lubricate the highways of commerce, *in time of war, at the mercy of the enemy who may either control the sources of supply or the means of transportation:* in either event our railways and factories will cease operation, our battleships will swing helplessly at anchor, and our country will resound with the martial tread of a triumphant foe."

Note should be taken of the similarity of the Requa and other World War I statements to utterances during and after World War II. Remember Ickes' assertion that this country cannot "oil another war"—that "our reserves have a relatively short life expectancy of 14 years" and that "it is up to us to look to the conservation and prudent use of what we have left!"

Or Senator Richard Russell's statement in 1943 that "we have been depleting our petroleum stocks at a ruinous rate" and that "the end of the war will find our own deposits practically exhausted!"

Forecast in 1919

Most pessimistic of the forecasters of the World War I period was David White, Chief Geologist of the U. S. Geological Survey. In the May, 1919 issue of the Journal of the Society of Automotive Engineers, White conceded the possibility of future sizable discoveries, but added that "on the whole, even with prices stimulating the driller to greater efforts, it seems unlikely that the domestic production of petroleum can at best gain appreciably on the reasonably expected increase in consumption." (How similar are these words to some heard in the last two years!)

He went on to say:

"The date when the peak will be reached is a matter of individual opinion, in which predictions have wide range. There are many well-informed geologists and engineers who believe *the peak in the production of natural petroleum in this country will be reached by 1921 and who present impressive evidence that it may come even before 1920.*"

In the May 1920 issue of The Annals of the American Academy of Political and Social Science, White undertook to interpret further the significance of these findings. Apparently convinced that the results of 1919 had confirmed his pessimism, he struck out more boldly. The opening paragraphs of his article in this publication follow:

"Petroleum in the United States is a wasting asset so far depleted as no longer to afford a secure foundation for the obligations based upon its assumed continued adequacy. Barring unexpected good fortune in the search for new supplies or even less unexpected curtailment of consumption, the petroleum production in the United States is likely not only never again wholly to meet our requirements, but even to start soon on the long decline of a waning output.

"For the first time in her history the United States is witnessing the day when one of her greatest stores of mineral wealth . . . is approaching exhaustion and so is no longer able to meet her growing necessities. After 60 years of prodigal generosity and profligate waste she discovers that her oil heritage is far spent and that henceforth she must become more and more dependent upon the stores of other countries."

White foresaw the exhaustion of American resources within 17 years "if the 1919 rate (nearly 380,000,000 bbl) of production could be maintained for so long, while a reserve of 7,000,000,000 bbl, a moderately liberal estimate, would disappear in 18½ years.

Fortunately, he continued, "the oil cannot so soon be taken from the ground," and he conceded the possibility that "finally by accident, long after the search has waned and even in the next century" additional oil pools will be found. For those reasons, he continued, "the production of natural petroleum in the United States must pass its peak at an early date—probably within five years, and possibly within three years—though the long, sagging production curve may be carried out beyond the century."

In this article it was White's reiterated opinion that "our domestic production may not go over 425,000,000 bbl a year—and it is not likely ever to exceed 450,000,000 bbl."

Pointing out that W. C. Teagle, then president of the Standard Oil Company of New Jersey, had estimated that the 1925 petroleum requirements of this country would approximate 650,000,000 bbl, White made this observation:

"A drain of over one-half billion barrels, even if the annual demand be not further increased, would, if taken from the oil fields in the United States, probably *exhaust the oil resources remaining available in the ground in 14 years or in 16 years,* if we assume that our recoverable oil possibly amounts to so much as 8,000,000,000 bbl, which to the writer seems very improbable."

Again appears the old refrain: "exhaustion of oil resources in 14 years!"

Meanwhile much was said about the necessity of the Government's establishing research laboratories for the development of processes for extracting oil from shale!

And, White, too, placed emphasis on our dependence on foreign oil resources. Thus in 1920, he asserted:

"Nothing is more certain than that this country must at an early date lose its supremacy in the oil world and become more and more dependent on the oil resources of other lands, except

Production and long-term availability of petroleum, 1939-1953
(In thousands of barrels daily).

Item	Year	Domestic crude petroleum	Domestic natural-gas liquids	Total natural liquid hydrocarbons	Foreign crude petroleum (Excl. Russia)
Actual production*					
	1939	3466	141§	3607	1627
	1940	3697	153§	3850	1543
	1941	3842	222	4064	1573
	1942	3799	228	4027	1295
	1943	4125	240	4365	1496
	1944	4584	273	4857	1729
	1945	4695	307	5002	1975
	1946	4751	316	5067	2321
	1947	5085	362	5447	2653
(Partly est.)	1948	5500	400	5900	3250
Est. availability†					Est. production
	1949	5850	450	6300	3580
	1950	6150	480	6630	3900
	1951	6410	510	6920	4330
	1952	6610	530	7140	4710
	1953	6770	550	7320	5010

Source: A.P.I. Subcommittee on Long-Term Availability of the National Oil Policy Committee, L. F. McCollum, Chairman.

*Per U. S. Bureau of Mines. †McCollum Committee's probable upper range from estimated average availability.
§Does not include some cycle condensate included in subsequent years.

insofar as the situation may be saved by the successful production of artificial petroleum by the distillation of oil shales."

White concluded that:

"We shall by 1925 be dependent upon foreign oil fields to the extent of 150,000,000 bbl and possibly as much as 200,000,000 of crude each year, except insofar as the situation may, by that time, perhaps, be helped to a slight extent by shale oil."

The assumption that the country had become dependent upon foreign oil gained further support when the United States Geological Survey in March 1921 invited the American Association of Petroleum Geologists to cooperate with it in a review of the producing, probable and possible oil territory of the United States for the purpose of compiling an estimate of the petroleum remaining in the ground and recoverable by present methods.

Proclaiming that the "estimates resulting from this survey are undoubtedly the best that have ever been made for the United States, and better than have hitherto been presented for any oil country or district of the world," the United States Geological Survey announced that on January 1, 1922, the estimated reserves of oil recoverable by methods then in use totaled 9,150,000,000 bbl.

The Geological Survey had these further observations to make regarding this finding:

"The annual production of the country is now almost half a billion barrels, but the annual consumption, already well beyond the half billion mark, is still growing. For some years we have had to import oil, and with the growth in demand, our dependence on foreign oil has become steadily greater, in spite of our own increase in output. . . .

"Of the total estimated oil reserves in the United States amounting in round numbers to 9,000,000,000 bbl, 5,000,000,000 bbl may be classified as oil in sight and 4,000,000,000 bbl as prospective and possible. . . .

"The estimated reserves are enough to justify the present requirements of the United States for only 21 years, if the oil could be taken out of the ground as fast as it is wanted. . . .

"The oil cannot all be discovered, much less taken from the earth in 20 years. *The United States is already absolutely dependent on foreign countries to eke out her own production, and, if the foreign oil can be produced, this dependence is sure to grow greater and greater as our own oil fields wane,* except as artificial petroleum may be produced by the distillation of oil shales and coals or some substitute for petroleum may be discovered."

Prophecies Failed to Come to Pass

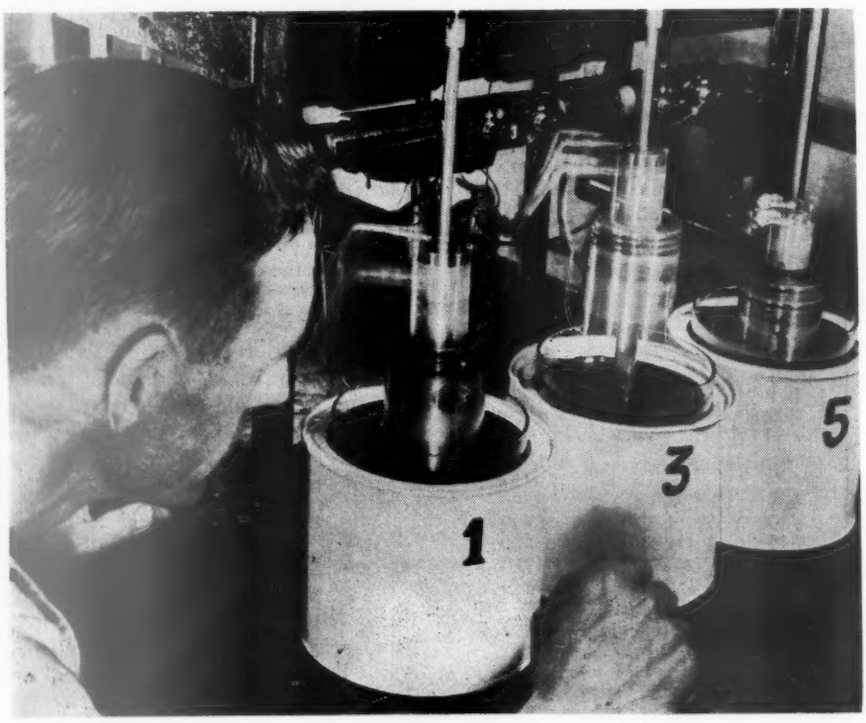
Thus for a period of roughly six years, commencing during the final half of World War I and continuing through the subsequent post-war readjustment period, the prevailing thought in high places was that our oil resources were so depleted as to make us dependent on foreign fields.

It would, indeed, be laboring the point to demonstrate precisely how all these prophecies of doom failed to come to pass. The oil industry's achievements last year, the proved reserve reports of the Lahee Committee and the McCollum Committee report already cited prove how wrong these "experts" of a previous day were. Indeed the last year proved, too, how wrong some present day oil experts can be! * * *

P 206.6

New Method for Measuring Piston Operating Temperatures

A new and modern method for the measurement of the actual temperature of a piston when operating at up to 2000 rpm in an engine has been developed by research engineers in the Beacon laboratories of The Texas Company, and was announced recently. In this new method, air-cushioned plungers are brought into contact recurrently with thermocouples located in the piston itself. The heat is determined by measuring on a meter the current induced in the thermocouple.



Thermocouple terminals are mounted on a holder which extends below the lower edge of the piston skirt; plunger tips which contact these terminals are located in the crankcase below. By means of air pressure introduced by push-button valves the plungers are forced outward to come into contact with the couple terminals at the lowest point on the downstroke of piston. After meter reading is obtained the valve closes, producing a vacuum behind the plunger and withdrawing it to its retracted position.

Other methods for determination of piston temperatures have failed because of high speeds, heat, piston motion and oil film formation. The wiping action of the new system prevents the formation of oil films, and the contact is maintained long enough that meters of extreme sensitivity are not necessary for good, dependable results. The illustration shows a laboratory setup employed in the development of the method. * * *

Arc Welding Army Conquers the Route of Cortez

THESE pictures show activity on the arc welded 135-mile, 20-inch gas line completed recently for Petróleos Mexicanos which brings gas from the Poza Rica fields (near Tampico) to Mexico City for industrial uses. It follows closely the route of Cortez in his famous march from the sea to conquer Mexico . . . from sea level, up over 10,000-ft. mountains, across flat lands, past the ancient Aztec pyramids to Mexico City.

The contractors, Williams Brothers Co. of Tulsa, Okla. used 15 Lincoln "Shield-Arc" welders and 62,000 lbs. of "Fleetweld 5" electrodes in conquering this problem for modern civilization.

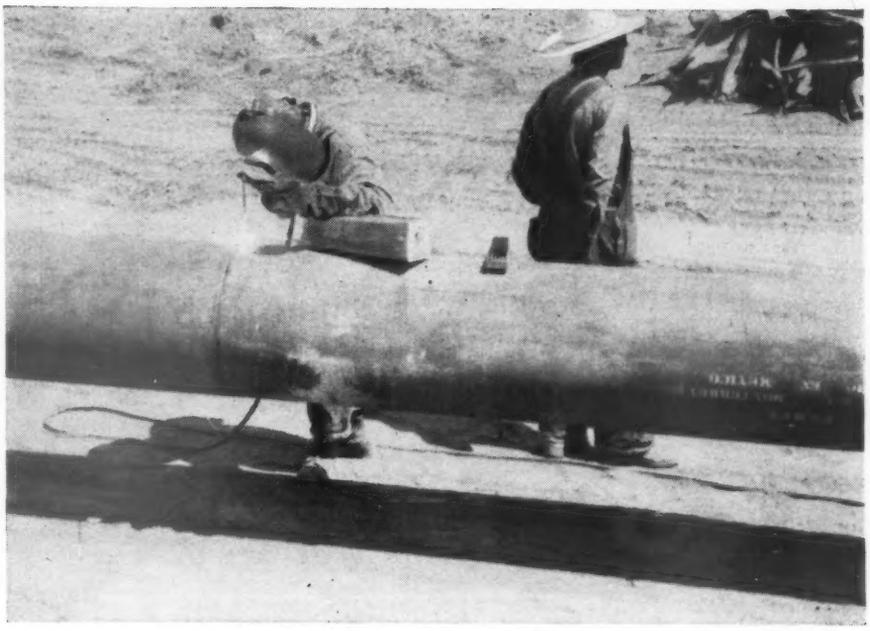
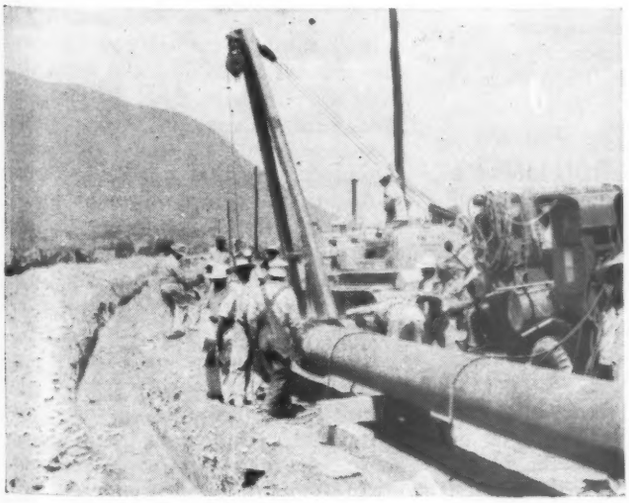


Fig. 1. The "soldier" in today's "Cortez" expedition wears a ray-protecting helmet and wields a weapon that melts steel.

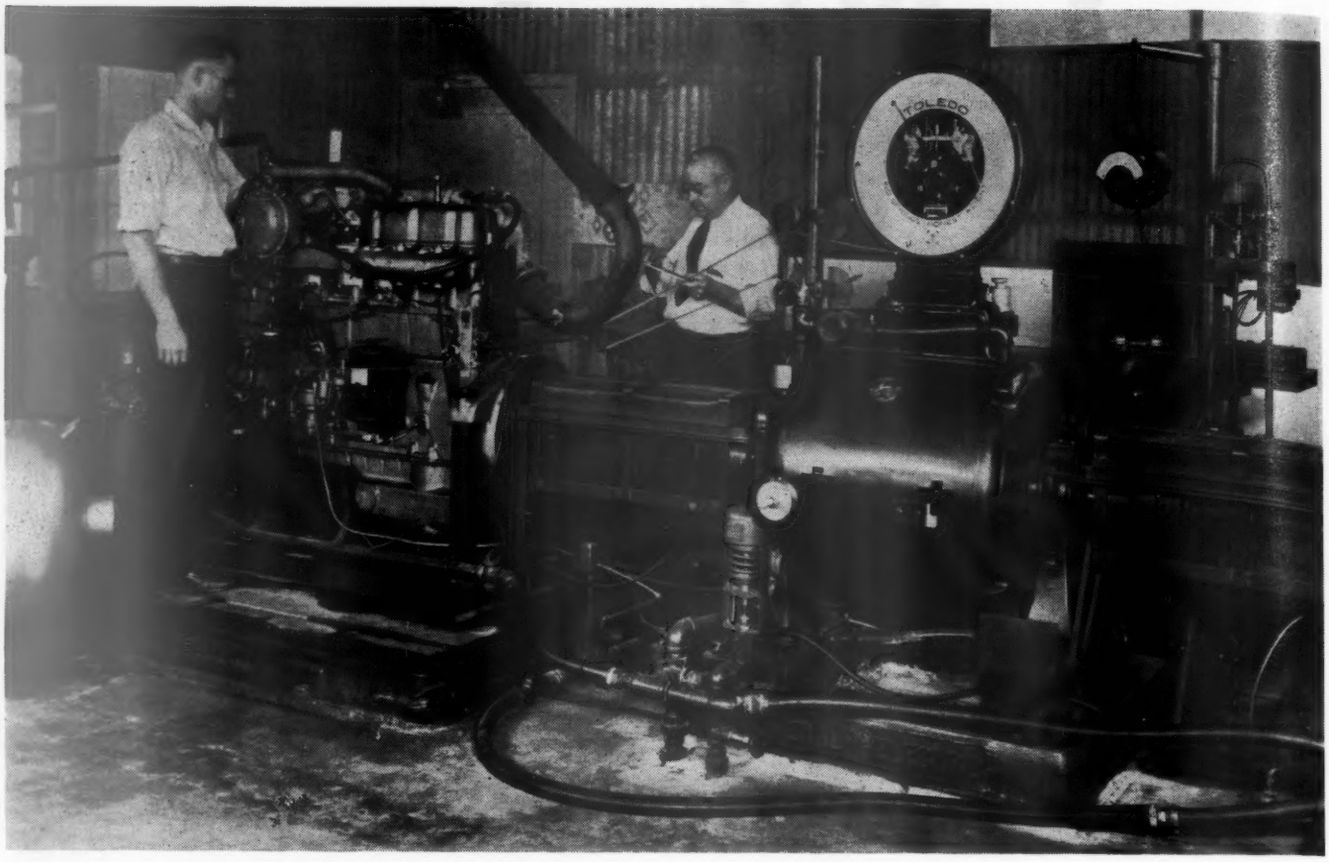
Fig. 3. (Right). This 20-inch pipe line was built by the "stove pipe" method. Beveled pipe ends are lined up, clamped and tack welded as shown. Finish welds are made in three passes.

Fig. 2. (Below). The pipe line has a capacity of 50 million cu. ft. of gas per day.



The above is published by **THE LINCOLN ELECTRIC COMPANY** *in the interests of progress.*

For assistance on arc welding problems in the petroleum industry, write The Lincoln Electric Company, Dept. 183, Cleveland 1, Ohio.



A view of the west end of engine test laboratory, showing new dynamometer connected to a popular make, heavy-duty truck engine. Harold Ensign, left, and Fred Laub are testing new butane-propane carburetion equipment.

New Tests Study Butane-Propane Engines

AFTER having just completed an extensive program of factory modernization and new product development, it is learned now that the Ensign laboratory, long known as one of the finest engine carburetor labs in the country, also is taking on a new look.

With the application of butane-propane to large engines for both transportation and industrial uses, Ensign has developed a new model "S" butane regulating unit as well as a line of larger carburetors for butane-propane and natural gas engines in excess of 450 hp. New and larger experimenting and testing equipment has been installed to fill this present need as well as anticipated requirements.

The photo shows installation of a new General Electric dynamometer on which is being tested a leading make of heavy duty truck engine. The new dynamometer will handle easily engines of 500 hp. It serves to check with extreme accuracy engine horsepower, speed, and many other important characteristics.

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The Luck of Henry Rouse

HARRY BOTSFORD†

THE luck of Henry Rouse became an oil field legend in less than eighteen dramatic months. Men who knew him intimately, however, acknowledged that his luck was largely of sound and instinctive judgment coupled with a boldness unexpected in one so frail and clerical in his appearance.

To be known as a partner or an associate of Henry Rouse was a mark of distinction, equivalent to a hallmark of integrity and business ability. Rouse was a shrewd judge of men, as he was of an oil property. If a man was known to be associated with the Rouse luck, he could virtually walk into any field bank and borrow a substantial sum on that intangible collateral.

Of the breed of robust and colorful characters spawned by the fledgling oil industry, the name of Henry Rouse is likely to be well and favorably known, especially in Warren County, Pennsylvania, where hundreds of poor people still live on his bounty, where fine and useful highways are maintained because of his generosity.

An ex-railroad conductor, an instrument of a capricious Fate, was responsible for the drilling of the world's first oil well at Titusville, a few miles from the hustling little valley lumber town appropriately called Enterprise. Henry Rouse was the best known of all the local business men. He was the owner of two large saw mills in the little town when he heard the news of the oil strike. He immediately decided to engage in this new, exiting and fascinating business. For years, it was to be an industry conducted by amateurs. Rouse was destined to be one of the most successful of these amateurs.

He was 35, a self-made man, unmarried. He was tall and slender, bearded in the fashion of the day. His eyes were direct, his manner invariably retiring but courteous. He was born of poor parents and had been no stranger to poverty. His was a success story. He had worked hard for an education, secured it, and became a teacher in rural schools. He was so well liked and so popular, he was persuaded to become a candidate for the State Assembly. He won the nomination and the election easily. He was a shrewd legislator, an alert politician, but plagued by idealism. Thrown in contact with political leaders of Philadelphia and Pittsburgh, they were seldom able to deceive him as to their motives. More than once he outsmarted them. His only speech, at the end of his service, was curiously effective and challenging.

He returned to Enterprise, started to buy and trade real estate with considerable success. Eventually, he became a lumberman, succeeded beyond his dreams. Honesty marked every transaction, men trusted him, accepted his word without question.

"His luck is too good to last!" men predicted, especially those who were slightly envious of his success, his reputation for integrity.

Rouse was generous and took great delight in finding some shabby youngster whose parents were in dire circumstances and doing something generous and unexpected for the lad. He would escort the boy into a clothing store and completely outfit him in expensive and comfortable clothes and new boots. At the nearest grocery store, he would buy as much as the boy could carry. Then he'd stuff some money in the boy's pocket and send him home. He never forgot his own lean years. In the painful hours before his tragic death, he was more than generous to those who stood in need of his bounty.

His luck tagged him into the oil industry. He was a man of decision, accustomed to reaching an objective with speed and regardless of obstacles. Such a practice paid big dividends in the early days of the oil industry. In the hectic month following Drake's discovery well, Rouse and his associates moved quickly and with great courage and daring. They leased land and started drilling wells on the Buchanan and Barnsdall farms, probably drilled some of the oil wells in the world. Every well they drilled, became a profitable producer. They never missed. Rouse and his associates, Samuel Q. Brown and John Mitchell, were superlatively busy and more than prosperous. The legend of the Rouse luck expanded to every corner of the oil fields; it was discussed on derrick floors, in pump houses, in banks and on the streets.

When Hank, Sam, and Jack leased a property preparatory to drilling for oil, other oil men rushed in and leased adjoining areas, so great was their faith in the Rouse luck and his unfailing capacity to find oil in paying quantities.

Rouse lived quietly and without display. A prodigious worker, he was usually accompanied by his confidential clerk and cashier, George Dimick. The two of them often rode a score of miles in a single day visiting oil properties. Dimick was efficient, tireless, completely devoted to Rouse.

It seemed that the luck of Henry Rouse would never run out. Yet it was to come to a dramatic and tragic end at Cherry Run, on the East bank of historic Oil Creek. Rouse was drilling the second well on a property, the first well having been a better-than-average producer.

It was the early evening of April 17, 1861, and grave news had just reached the bustling little oil town. Rouse, Dimick, and others were eating a leisurely supper in the crowded dining room of the Cherry Run Hotel. The news, somewhat delayed, stated that Fort Sumter had been fired upon and had fallen.

"This will mean war and the death of thousands of Americans," Rouse sadly commented. "It is strange to contemplate this business of death, whether it's wholesale or retail. I'm not afraid of it. But death, like luck, is capricious and unpredictable."

A minister seated at the table listened with interest. He leaned toward Rouse and shook an admonitory finger at him. "Mr. Rouse, you speak somewhat lightly of death! Are you prepared to meet your God?"

Rouse's thin bearded face split in a gentle grin and he said, very quietly: "You may not know it, Reverend Jamison, but I have no settled religious convictions. It's a matter about which I never argue. I do have some strong and interesting convictions about death and luck and what I think

†Author of "The Valley of Oil" and other well known works on the history of oil.

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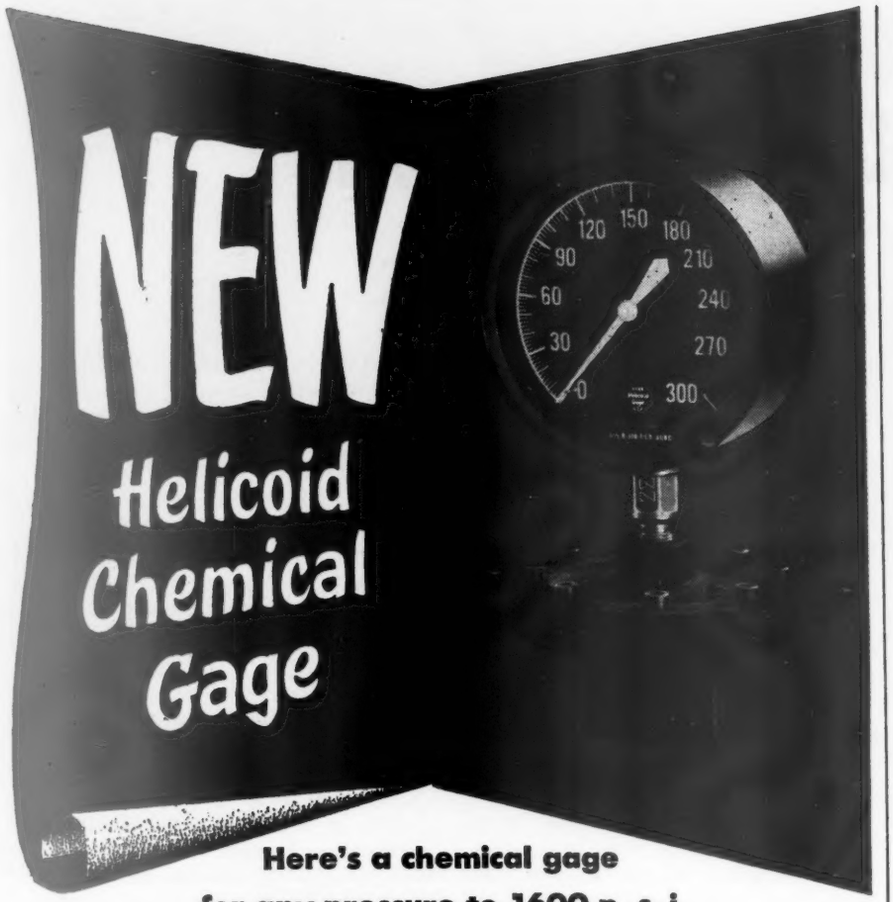

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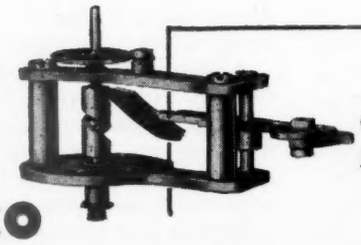

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constitutes good manners, if you would care to discuss them with me."

The minister flushed, turned to his pork chops and attacked them with vigor. Rouse's gray eyes twinkled briefly as he lighted his cigar, his lone vice.

The men were about to push back from the table when the building shook and a curious trembling roar became dominant above the clatter of knives and forks, above the drone of conversation. Heavy feet noisily clattered down the hall and a man, drenched with oil, rushed into the dining room, sighted Rouse and yelled, "The well's come in, Mr. Rouse, the biggest damned gusher you ever see! She's spewin' the full size of the casing head, and b'Jesus, we gotta get barrels and tankage quick or you'll lose thousands of dollars!"

Rouse came to his feet, As usual, he didn't hesitate with his decision. "George," he commanded of Dimick, "hustle around town and buy every empty barrel you can find. Hire every man you can find, buy picks and shovels for them, send them down to the well—double wages for them. Hire every team and wagon you can round up. Money is no object! You'll find me at the well. Get moving!"

He strode out, shouldering his way through the excited crowd. Dimick huried out of the hotel through the back door. He could hear the roar of the flowing well, a sinister, howling liquid voice. People were rushing toward the sound, plunging through the dusk. He wished he could join them. He though wistfully of Henry Rouse, who would be close to the action, wistfully wished he could be at his side.

He didn't know it, but Rouse's orders were to save his life.

He hurried about his business, hired men and teams, bought barrels at reckless prices. But, a precious flow of oil must be salvaged, regardless of the cost of salvage. As he wearily turned toward the well, it was deep dusk and he noticed that it was raining, a slow warm drizzle. There was a slight gound mist. The banshee wail of the flowing well was unabated, erupting at the rate of 3000 barrels a day, drenching the ground with liquid gold. In a year, such a well would produce a million dollar's worth of oil, he estimated. Rouse luck again!

He trotted around a corner just in time to hear a thunderous explosion and to witness a blinding flash, followed by a towering torch of flame that soared up through the misty dusk. Three acres of oil-soaked ground, two oil wells and derricks, buildings and large tanks filled with fresh oil, fed the fire, implemented by the steady

flow of oil from the well. The liquid scream of the well mounted above the cries of the men trapped in the flaming acres, and now there seemed to be a savage, exultant note in the voice of the well. Or, did Dimick imagine it?

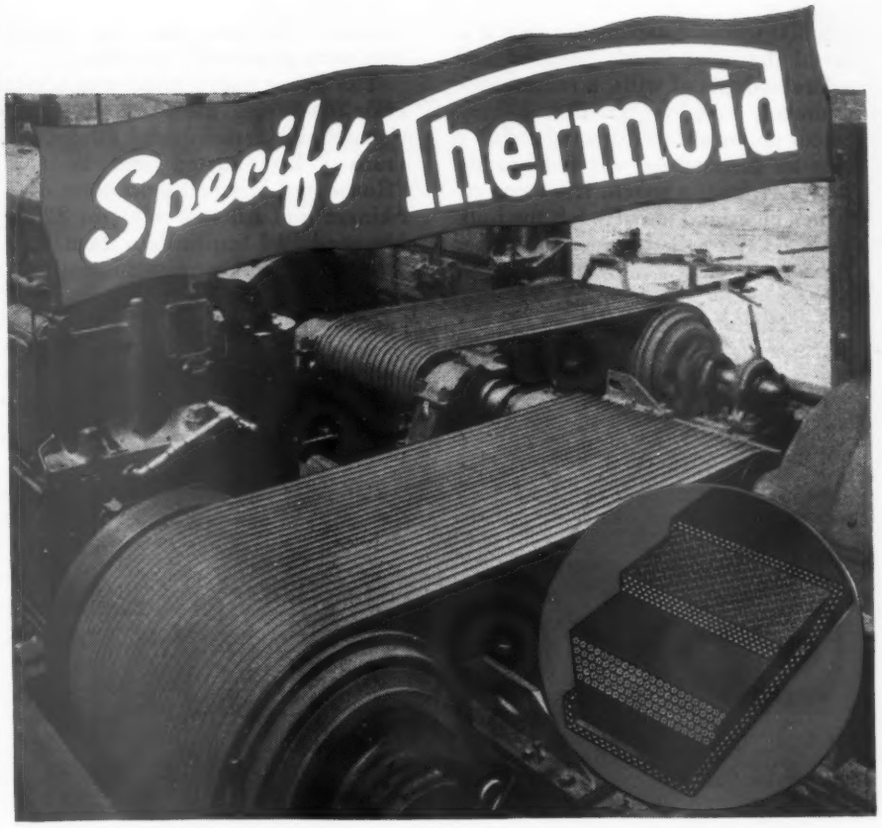
Henry Rouse had been standing within twenty feet of the well, directing operations, when the explosion took place. The oil, spreading beyond control, had reached the open fire of a drilling boiler a hundred yards away, setting off the inferno in a split second. Hemmed in on all sides by solid walls of flame, Rouse started to run through the flames toward safety. He slipped and fell and the flames swept over him. He struggled to his feet, ran a few more feet. In that interval, he knew there was no hope, that his luck had run out.

He reached in his pocket, pulled out his purse which contained a large sum of money. He threw it through the flames fencing him in. It was followed by a bundle of valuable papers he had carried in the inside pocket of his coat. Then he staggered and fell, a living torch. A little breeze parted the flames and two men rushed in and brought out what was left of Henry Rouse.

They carried him to a nearby shanty, tenderly placed him on a rough cot. It was obvious that he could not live. Rouse knew it. They fed him water from a spoon and his seared lips parted in what was meant for a smile of gratitude. In a low, tortured voice, he called for George Dimick.

"I want to make my will," he said weakly. He was in an agony of pain, yet he uttered no word of complaint. During the next four hours he dictated and revised his last will and testament, a concise document that precisely disposed of his far-flung oil properties and nearly a million dollars in cash. The entire will contained

Of the nation's current petroleum production 84 per cent comes from 5 states—Texas, California, Louisiana, Oklahoma, and Kansas. By adding the next 5 largest producing states, the 10 leading states account for 95.8 per cent of U. S. production. This second group includes Illinois, Wyoming, New Mexico, Mississippi, and Arkansas.



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only 800 words. Lawyers say that it is one of the most clearly phrased and understandable of wills, a remarkable document, considering the circumstances under which it was written.

As he dictated he was fed brandy and water from a spoon. His voice remained clear and low. He left the bulk of his estate to the Commissioners of Warren County, Pennsylvania, with one-half of the income to be used for the benefit of the poor of the county; the balance of the income was to be used for the improvement of county highways. He left a life income to his father, lump sums of a substantial nature to friends, employees, and associates. The two men who rescued him were generously rewarded.

The dying man's mind was crystal clear. Suffering the torments of the damned, he remembered others. His cracked lips parted and he said, "Rouse and Mitchell hold notes of A. Skinner and Allen Wright for $2500. My one-half I bequeath to them. They are having hard enough times without having to pay the notes."

Dimick's hand was shaking and there was a great ache in his heart as his beloved boss dictated. There were many bequests, decent deeds that meant survival for hard-pressed oil men obligated to Rouse.

When the will was completed, it was signed by witnesses and Dimick stuffed it in his pocket and went outside for a breath of fresh air. The fire was still ranging; the howling of the well continued. He could hear the shouts of men trying to bring the gusher under control, to extinguish the raging fire. Nineteen victims that fire had claimed. The sky was covered by a pall of black smoke. Angry red and yellow flames shot up through the drizzle. He was very tired, badly shaken.

Sadly he turned back into the shanty. He had just reached the cot when the crowd parted respectfully and the Reverend Jamison walked over and stood looking down at the charred body of Henry Rouse. Only the eyes seemed alive. The minister fell to his knees beside the cot and compassion was in his voice. "You are soon to meet your God, Mr. Rouse," he said quietly. "Why not make your peace with Him?"

The gray eyes were unflinching. The cracked lips whispered the answer. "My account is made up. If I am a debtor, it would be cowardly to ask for credit now. I do not care to discuss the matter."

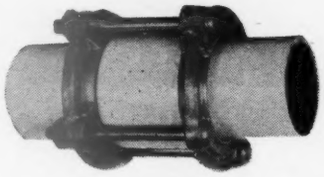
Baffled, strangely disturbed, the minister got to his feet, walked stiffly out of the shanty.

Four hours from the time of the explosion, Rouse mercifully lost consciousness. Within an hour he was dead. But, before he lost consciousness, he instructed Dimick as to his funeral. He told him where he was to be buried, requested that there be no sermon, no formal ceremony.

His luck had run out, men said. It was three days before the well was brought under control, the fire extinguished. It happened at the precise time the body of Henry Rouse was being lowered in the grave. Within a week the well ceased to flow. In a month it was worthless. There used to be a small marker at the site of the well, at Rouseville.

If Rouse's luck ran out, the luck of the people of Warren county has been continuously good. The poor of the county have been adequately taken care of because of his generosity. No county in the Commonwealth has better highways. There is a monument to his memory on the lawn of the County Home. It isn't a very good piece of sculpture, but the aged, the penniless men and women who reside there in the sunset days of their lives, often pause before it and say something kind about Henry Rouse.

Possibly they say prayers for the happy repose of his soul. * * *



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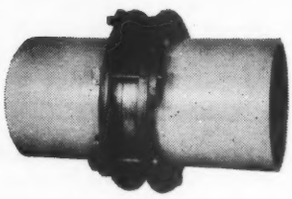

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Petroleum Profile

DEAN A. McGEE
Executive Vice President
Kerr-McGee Oil Industries, Inc.

DEAN A. McGEE is the personification of native ability, technical knowledge, executive leadership, and dynamic energy all wrapped up in one package. He has combined those attributes in developing Kerr-McGee Oil Industries, Inc., into one of the nation's leading oil companies.

Born in Humboldt, Allen County, Kansas, March 20, 1904, McGee worked as a boy in a garage after school hours and during vacations. He also drove a truck, worked in a bicycle shop, was engineer at the ice plant, and ran a pipeline commissary when a high school senior.

His ambition and insatiable thirst for knowledge took him to the University of Kansas at Lawrence, where he obtained a Bachelor of Science degree in Mining Engineering in 1926. At the University he was a Tau Beta Pi, belonged to Sigma Xi and the K-Club, worked Saturdays and summers to stay in school.

During the summer of 1926 he did geological work for Phillips Petroleum Company, returning to his Alma Mater for the 1926-27 school term as instructor in the School of Engineering Geology. But he felt industry offered opportunity and, at the end of the school term in June, 1927, he joined Phillips Petroleum Company as a petroleum geologist.

After a short time in the company's Bartlesville, Oklahoma, office he was transferred to South America where he did exploration work during 1927 and 1928. Upon his return to the States he was assigned as geologist to the Shawnee, Oklahoma, district.

The rapidly expanding Oklahoma City field then was attracting worldwide attention and, in 1930, McGee was appointed district geologist for the company in Oklahoma City. Because of his work there he was appointed chief geologist for Phillips in 1935. In 1937 he left the company to team up with Robert S. Kerr in the Kerlyn Oil Company, becoming vice president in charge of production and exploration; later he was designated executive vice president of the company. In January, 1946, the company name was changed to Kerr-McGee Oil Industries, Inc.

Under McGee's guiding hand, the Kerr-McGee company has expanded until now its operations extend from the waters of the Gulf of Mexico to the peaks of the Rocky Mountains. As a result of his geological work, Kerr-McGee acquired acreage in many of the nation's highly productive areas. He was one of the first to recognize the potentialities of the West Edmond area in which the company obtained valuable holdings. He pioneered many innovations in drilling and production lines, including use of a combination platform-barge for drilling in the open waters of the Louisiana coast.

Kerr-McGee now is engaged in drilling, producing, refining, and marketing of petroleum and its products.

McGee's interests have not been restricted to the oil and gas industry. In addition to being executive vice president and part owner of Kerr-McGee Oil Industries, Inc., and president of Fen-Ter Refining Company, he also is chairman of the board of Republic Supply Company, vice president of Kerr-McGee Building Corporation, president of Downtown Airpark, president of West Central Broadcasting Company, vice president of All-Oklahoma Broadcasting Company, treasurer of Enid Events Publishing Company, and director of the Colorado Interstate Gas Company and Liberty National Bank of Oklahoma City.

He also is a partner in Kerr-McGee and Company and trustee of Midwest Research Institute, Kansas City. He is a member, director, or executive of more than twenty regional, national, and international oil and engineering associations and societies, including the AIME, AAPG, API, IPAA, and Mid-Continent Oil and Gas Association. He has been a prolific writer on technical subjects relating to oil and gas geology and production. He also is active in civic organizations.

He married Dorothea Antionette Swain of Bartlesville on June 28, 1938. They have two daughters, Marcia Ann, 8 years old, and Patricia Dean, 6 years old. He is a Mason and an elder in the Westminster Presbyterian church.

Preventive maintenance cuts tractor cost

WALTER W. BLACK, International Harvester Company

EXCLUSIVE

In the battle for diesel tractor operating profits, efficient preventive maintenance is a strategic attack. Alertness of the operator in detecting trouble symptoms before a problem becomes serious, and his watchfulness over conditions which may cause poor operation, is the one-two punch which can send repair costs reeling.

As one diesel tractor owner and operator puts it, "It's a lot cheaper to prevent trouble than to cure it!"

The tractor operator is the pay-off man insofar as preventive maintenance is concerned. He alone is with the tractor while it is operating, and he alone is in a position to know what is going on. It is up to him to determine whether the tractor has been properly serviced, and to note when the attention of a service mechanic is required. Without advice from the operator, service personnel are stymied until the tractor is delivered to them for major repair.

Few serious engine problems, except rare cases of structural failure, occur spontaneously. There are usually contributing causes. Fortunately, many of these contributing causes produce operational symptoms which indicate that a more serious problem is brewing. By noting this symptom and acting accordingly, the operator can often forestall more serious damage.

An illustration will make this clear. Let us take the case of a diesel engine cooling system that has accumulated a heavy scale due to mineral deposits from the cooling water. The scale affects cooling system efficiency in two ways—it restricts the flow of cooling water, and acts as an insulator between the coolant and the hot portions of the engine. This will cause the engine to overheat. Initially, this overheating is a symptom only as no mechanical damage has actually occurred. But continued engine operation at high temperatures will eventually cause cracking of cylinder heads, usually around valve ports. The net result will be a costly repair job—an expense that would have been materially reduced by early recognition of the symptom and proper corrective measures.

An experienced operator will not permit such a series of events to complete its vicious circle. He will note a symptom the moment it occurs, and will call it to the attention of service personnel. A thorough check-up at this time will usually uncover the seat of the problem before serious damage occurs.

Operational trouble symptoms for which to watch include engine overheating, smoky exhaust, excessive fuel or oil consumption, a loggy engine, loss of power, and unusual engine knocks or noises. Any one of these symptoms should serve as a red-light warning to the operator. It is a signal for immediate action. It indicates that something is wrong somewhere, and when the operator cannot remedy the problem, he should call it to the attention of service personnel.

But efficient preventive maintenance demands more of the operator than mere observation of engine operation—it de-

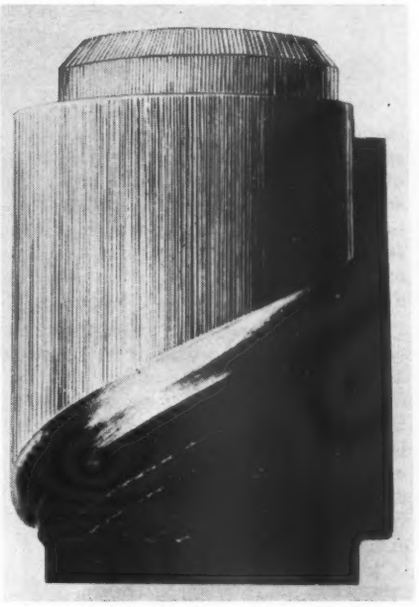


FIG. 1. Here is what happens when dirt gets in the fuel system. This is a magnified photo of a fuel injection pump plunger showing wear and grooves caused by dirt.

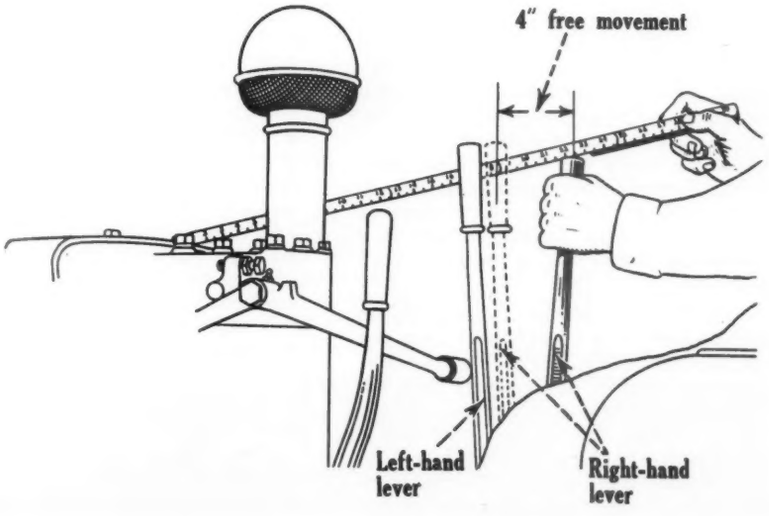


FIG. 2. Good preventive maintenance means constant checking. Note the method used here for measuring play in controls. When this play becomes excessive, an investigation is in order.

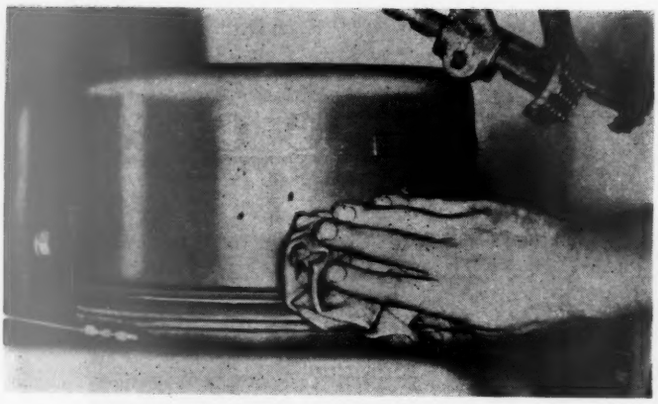


FIG. 3. Cleanliness is a prime preventer of trouble. Wipe the outside of the air cleaner oil cup carefully prior to removing it.

FIG. 4. Frequent inspection of the oil filter elements should be made. Change them as soon as they become dirty.

mands a thorough knowledge of tractor service requirements, and a knowledge of factors in servicing which may cause subpar engine operation to occur. Then, too, there are instances where inferior servicing and inspection may result in extensive engine damage without producing initial operational symptoms.

Aside from normal wear, most mechanical troubles accrue from functional troubles which originate in the cooling, lubrication or fuel systems. As already noted, simple scaling in the cooling system, initially a functional trouble, may in time result in extensive engine damage. The same logic applies to minor functional troubles or defects which occur elsewhere.

The cooling, lubrication and fuel systems control the functional aspects of engine operation, and in most cases when functional operation is affected, it is only a matter of time until mechanical operation will be affected likewise. Herein lies the value of preventive maintenance in reducing operating costs. Correction of functional problems usually requires only adjustments or minor repairs; correction of mechanical problems generally involves an outlay for new parts plus costly installation time.

The cooling system of any engine can be the seat of many functional problems. Engine overheating is the most common symptom that will occur when the cooling system is defective. In a few instances, when the diesel engine fails to reach its optimum operating temperatures (180 to 200 F), thus tending to run cold, it may be due to use of a thermostat that opens at too low a temperature.

The function of the cooling system and coolant is to absorb heat from the engine and dissipate it into the surrounding air. To accomplish this efficiently, a certain volume of coolant must circulate through the system in a given interval of time. When this volume is reduced, the coolant absorbs more heat than it can dissipate, and as it becomes hotter, its heat absorption power is reduced accordingly. The net result is a hot engine.

There are several factors which may reduce the amount of coolant circulating through the system. These include: (1) a badly worn water pump impeller, (2) a slipping fan belt which fails to drive the water pump at the proper speed, (3) restriction in the system passages and lines caused by scale or other dirt, and (4) leaks which permit air to enter the system, filling the coolant with small air bubbles, thus reducing its effective volume.

When a badly worn water pump impeller is suspected, it should be checked by a mechanic. A slipping fan belt, especially if the slippage is slight, is difficult to detect, but the trouble can be eliminated by increasing the fan belt tension. When the belt is badly worn, frayed, or oil-soaked, it should be replaced.

Excessive scale, dirt, and other sediment in the cooling system may be suspected when ordinary hard or well water has been employed as a coolant. When possible, rain water should be used for this purpose as it contains less scale-forming impurities than surface water. The presence of excessive scale may be suspected when other possible causes have been checked and the engine continues to overheat. Aeration of the coolant may be checked by examining its appearance through the radiator filler neck while the engine is running. Tiny air bubbles in suspension will give the fluid a milky or cloudy appearance. When aeration is evident, check to see where air is entering the system.

Under dirty operating conditions, dust, leaves, insects and other trash may be sucked into the radiator cooling fins by the fan, thus effectively hampering the flow of cooling air. Reverse flow fans are available for most tractors, and should be installed when continued dirty operating conditions are anticipated. The radiator shroud, controlling the flow of air past the engine, must be kept in good condition.

A cardinal rule which should be observed by all operators is to never start the engine while the cooling system is dry. This is important. Under such conditions, only a few moments of operation are required to heat the engine beyond the safe operating range. Subsequent addition of the coolant causes rapid cooling and contraction of the hot metal. Though a crack may not occur at the time, such rapid contraction sets up internal stresses and increases the danger of subsequent failure.

Fortunately, the lubrication system of most diesel engines is nearly fool-proof. But this does not relieve the operator of proper responsibility. He must make certain that the right grade of oil is used to maintain the oil supply at the proper level, and that only clean oil is placed in the engine. He should note immediately any drop in oil system pressure, and report it to a mechanic. He should insist on periodic oil changes, and should acquaint himself with the amount of oil consumed between changes. He must make certain that all oil filter elements are inspected and changed when necessary. The dirt in the oil filter element and in the crankcase drainings should be inspected for small particles of metal which will indicate that the crankcase bearings need attention.

The fuel system is the heart of the diesel engine, and as such demands rigorous and constant attention. Precautions in purchasing, storing and handling of diesel fuels will eliminate many

possible trouble sources. Make certain that the right grade of fuel is used, and that it has been stored in a dirt-free container properly trapped against moisture condensation. Refill the tractor fuel tank after each day's operation to eliminate internal moisture condensation during the night. Check and clean fuel system water traps daily or oftener if required.

The fuel filter should be vented each time the fuel runs low to make sure that air does not enter the system. Filter elements should be inspected regularly and changed when necessary. Never prolong the use of dirty filter elements as even a slight trace of dirt in the fuel lines may cause injury to the close-fitting fuel injection pump parts.

Common symptoms of fuel system trouble are a loggy engine, loss of power, erratic operation, and smoky exhaust. When a cursory inspection by the operator fails to locate the trouble, an experienced mechanic should be called in on the job. Prompt correction of the conditions causing the symptom will reduce the possibility of extensive mechanical damage.

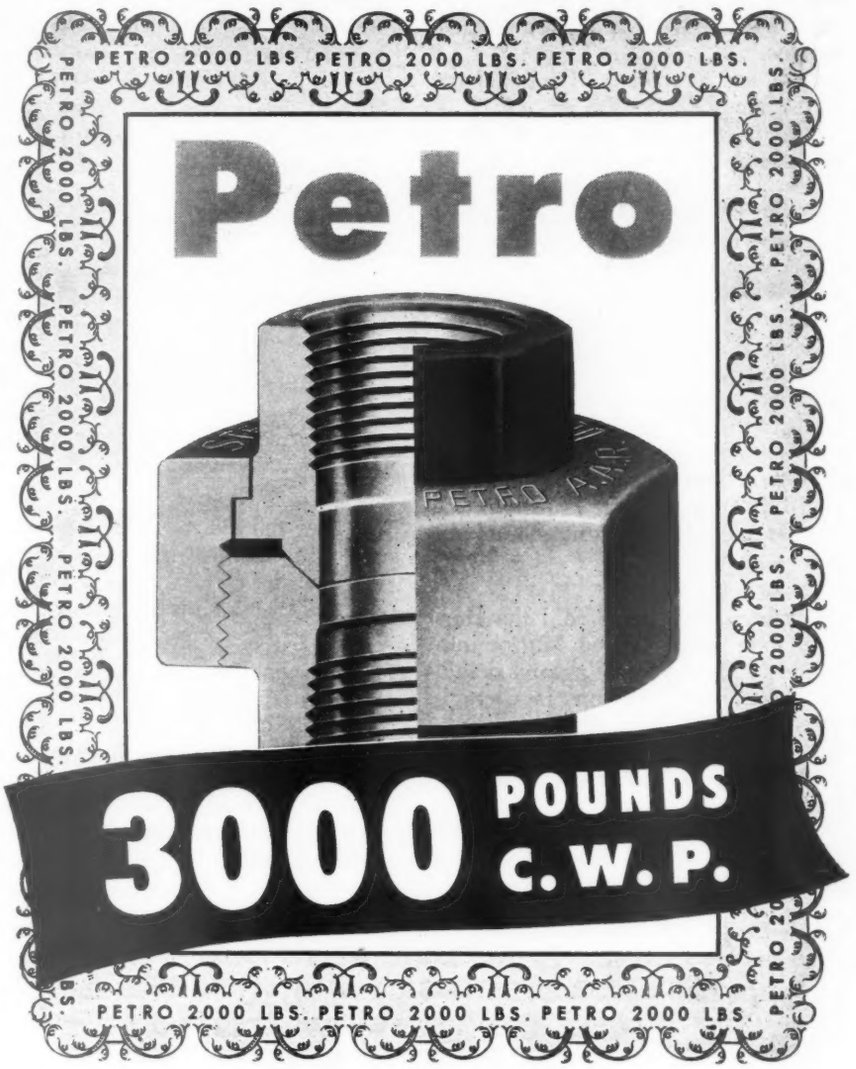
Insofar as diesel engine preventive maintenance is concerned, proper operation of the air cleaner ranks most important. Roughly, 90 per cent of all engine wear is caused by dirt which enters along with intake air. Cases are on record where a defective air cleaner has necessitated a complete overhaul, with replacement of pistons, rings, and cylinder liners, after some 60 hours of operation. Danger from this source is materially amplified by the fact that a defective air cleaner does not produce easily recognizable operational symptoms.

The operator must make certain that the air cleaner oil bath is changed at regular intervals, and that all gaskets and seals are in good shape. Consistent dry weather operation may cause the gaskets and seals to shrink, thus permitting leakage of unfiltered air past the oil bath cleaner cup. All cleaner lines and hoses should be inspected at regular intervals for loose connections, or for worn spots or holes caused by chafing and vibration. Particular attention should be paid to places where the lines or hoses are held in support, or where they touch against the engine, its hood structure, or other members of the tractor frame.

It is not the purpose of this article to imply that a tractor operator must become an experienced service mechanic. Rather, we have tried to point out how the operator may exercise sound judgment in reducing the number of times his machine must go to the shop for major repairs. We have indicated certain operational symptoms which warn that trouble is in the making, and other contingencies which may cause trouble to occur. The ability to note these factors is important. Such ability coupled with keen observation is preventive maintenance at its best. It's that old "stitch in time" axiom with a mechanical twist.

* * *

A NEW PICTURE IN AN OLD FRAME



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Nut threads are permanently lubricated with Udylite Cadmium (plated). "PETRO" screwed, "PETRO" Socketweld, and "PETRO" Hi-Speed are recommended for severe service on ammonia, air, gas, oil, steam, and water.

Other products listed in CHEMICAL ENGINEERING CATALOG, pages 814, 815. REFINERY CATALOG, page 488. COMPOSITE CATALOG, pages 2500, 2501.

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PIONEERS OF STEEL UNIONS SINCE 1912

CLAYTON MARK & COMPANY

1900 DEMPSTER STREET • EVANSTON, ILLINOIS

LAUGH WITH BARNEY

An English hostess, when serving wine, remarked to one gentleman: "I should not be offering you wine. You are the head of the Temperance League."

"Oh, no" he replied, "I am the head of the Vice League."

"Well," said she, "I knew there was something I should not offer you."

"I hear," he said hopefully, "that you have a propensity for petting."

"A dirty lie!" she cried. "All I have is a davenport."

Willie: Paw, what is discretion?

Paw: It's something, son, that comes to a person after he's too old for it to do him any good.

Father: I see by the gasoline tank you didn't get very far last night.

Son: Well, Dad, I'm not complaining.

"Winter draws on," said the Harvard man as he tucked Muriel into an old-fashioned New England sleigh.

"Is that any of your business?" asked Muriel coldly.

"Her niece is rather good looking, I think."

"Don't say 'Knees is,' say 'Knees are.' "

Maizie: You've been stenographer for nearly all the big shots in this department store, haven't you?

Mabel: Yes, I'm just about on my last lap now.

When a pretty girl got on the crowded bus, a pale-looking fellow started to get up. But she pushed him back into the seat, and said she preferred to stand. Again he tried to get up and again she pushed him back. Finally he yelled, "Now listen, lady! I passed my stop two blocks back—let me out!"

A sailor wandered into the tennis match and sat down. "Whose game?" he asked. A shy young thing looked up hopefully, "I am."

"They tell me your son is mechanically inclined."

"Well, he certainly has a knack of tinkering with a miss in a motor."

The school teacher sent a note to Willie's mother to say that he was positively dirty.

Willie's mother sent back a reply, which said:

Dere teacher, I knows as Willie's no rose, but I sent him to be teached, not smelled.

The teacher was attempting to explain the difference between "concrete" and "abstract" and to make it very clear and simple she said:

"Concrete is something you can see, while abstract is something you can't see. Now George, give me an example of something concrete."

"My pants."

"Correct: now something abstract."

"Yours."

The civilian jeep skidded around a corner, snicked off a phone pole, ricocheted along three cars, upset eight pedestrians, ran into a stone wall, and then stopped. A glamorous thing in bobby sox stepped rapturously from the wreckage. "Boy," she was saying, "that's what I call a kiss!"

"What color bathing suit was she wearing?"

"I could not tell. She had her back turned."

Wallflower: I'm fit as a fiddle, but . .

Blonde: . . . you need a beau to play with!

"Whassa matter, Flo?"

"Gawd, Mae! Never go out with a chiropractor!"

Baby: I want my bottle.

Mother: Shut up, you sound like your father.

Jim: Woman's greatest attraction is her hair.

Bob: I say it's her eyes.

Joe: It is unquestionably her teeth.

Bill: What the hell's the use in all of us sitting here lying to each other?

The elevator was tightly jammed when a girl said fiercely: "Take your hands off me, you louse! No, not you. YOU!"

Two skeletons locked up in a closet were talking.

"What are we doing in this musty old hole, anyway?"

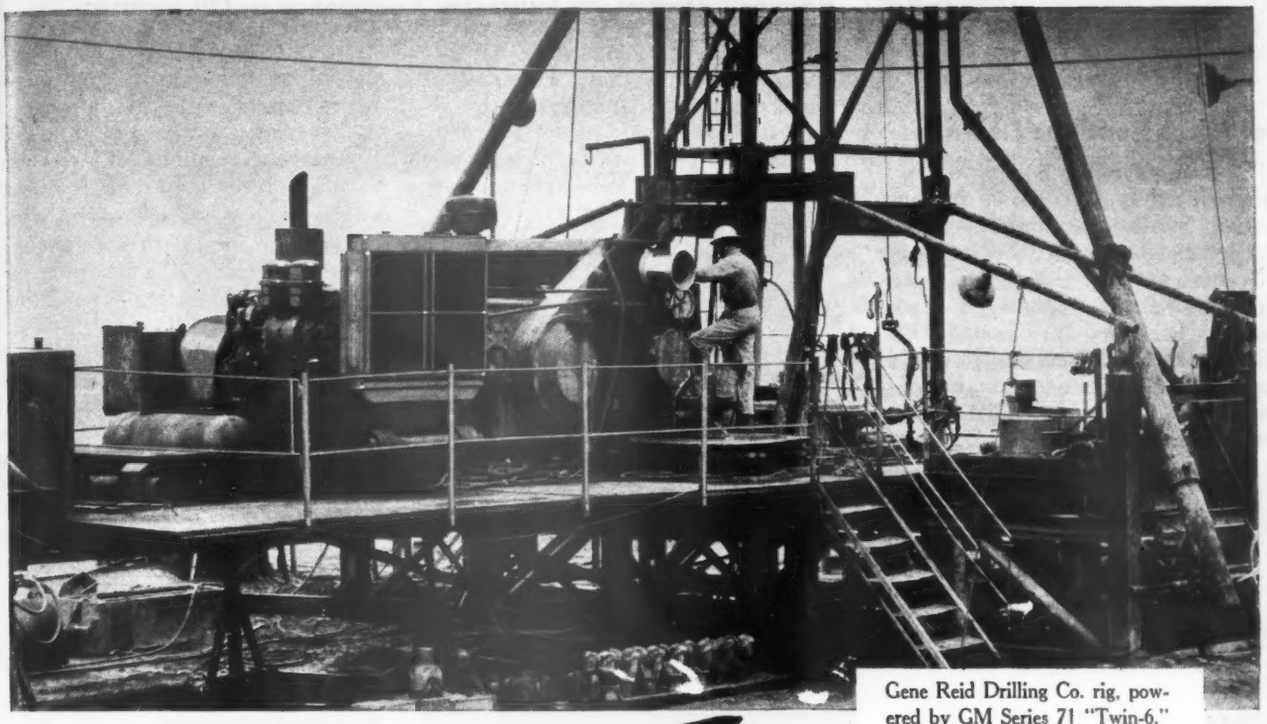
"Darned if I know. If we had any guts we'd get out of here."

"Me slept with daddy last night," said the small child to the kindergarten lady who believed in correct diction, even by the very young, and with emphasis said,

"I slept with daddy last night."

"Well, then," said the child, "you must have come in after I went to sleep."

There go a cute pair. He's a weight lifter and she's a dumb belle!



Gene Reid Drilling Co. rig, powered by GM Series 71 "Twin-6." The unit consists of a McCarthy-Bender 96′ mast and Emsco 936 draw works, drilling near Tejon Ranch, California.

Round Trip IN HALF THE TIME

YOU can take the word of D. E. Crandall, maintenance superintendent for Gene Reid Drilling Co., Bakersfield, California, that a General Motors Series 71 Diesel engine has no equal for fast, dependable performance in drilling service. He reports:

"Since November 1947 our rig has drilled seven wells, averaging 4000 feet each. With our GM Twin we make a round trip in half the time—it never stalls and not one cent has been spent in repairs. You just can't beat a GM engine for oil well drilling!"

Men who use them know—GM Series 71 Diesel engines deliver the rugged, flexible power required for oil-well drilling. Two-cycle operation—power at every downstroke—makes them unusually powerful for their compact size and weight. They pick up loads fast and respond instantly to varying power demands.

Simplified design makes maintenance an easy matter. Sensible size and weight make it easier to rig up and cut moving costs.

Before you buy new equipment or repower old units, it will pay you to get the facts about GM Diesel power. *Write, wire or phone for details.*

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SINGLE ENGINES.. Up to 200 H.P. DETROIT 28, MICHIGAN MULTIPLE UNITS.. Up to 800 H.P.

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George Engine Co. NEW ORLEANS 18, LA.
Western Machinery & Engine Co. ST. LOUIS 10, MISSOURI
Diesel Power Co. OKLAHOMA CITY, OKLAHOMA
Empire Machinery Ltd. ODESSA, TEXAS
West Coast Engine & Equip. Co. BERKELEY, CALIFORNIA
United Tool & Valve Repair Co. SHREVEPORT, LOUISIANA
Seitz Machinery Company Inc. BILLINGS, MONTANA
Stewart & Stevenson Services Inc. HOUSTON 11, TEXAS
Gehring Equipment Co. CASPAR, WYOMING
Scranton Machine & Supply Co. GREAT BEND, KANSAS (Dealer)
Mountain Tractor Co. MISSOULA, MONTANA

NEWS

Fuel Prices Continue Down

The price of home heating oil has been reduced the sixth time in four months. Socony-Vacuum Oil Company set its Manhattan retail price at 11.2 cents a gallon. Sylvester Oil Company, marketing affiliate of Esso Standard Oil Company, posted 11.4 cents per gallon, but added it would knock off 0.3 cents a gallon for deliveries of more than 300 gallons. The present price compares with 12.8 cents last December.

In Philadelphia, Atlantic Refining Company announced a reduction in No. 6 fuel oil prices. The price in tank cars has been reduced 10 cents a barrel from $2.15 to $2.05. The price in tank wagons has been lowered from 6.12 cents to 5.88 cents a gallon.

The reductions are the logical reaction to the build up in stocks during a heating season that was generally warmer than usual and averaged 25 per cent above normal in New York.

War Efforts Recognized

A Certificate of Merit from President Truman was presented recently to William C. Heath, president of the A. O. Smith Corp. The presentation was made in Milwaukee by Maj. Gen. Paul L. Williams, commanding officer of the 10th Air Force. The certificate was awarded for work that was done by A. O. Smith during the war in the development and production of welded hollow steel propeller blades. In addition to the blades, A. O. Smith was a large producer of bombs, torpedo air flasks, and landing gear for bombers. The company made all of the B-29 landing gear.

Hoover Commission Expresses Confidence in Oil Industry

The Hoover Commission has reported to Congress that: "For exploration, development, and exploitation of deposits in the first class (petroleum), private enterprise can be relied upon in the future, as in the past, to meet the nation's needs, provided that the normal incentive of profits commensurate with the risks inherent in such enterprise is not destroyed through excessive taxes or arbitrary controls."

The group recommended: "Activities of government agencies with regard to development and exploration of such deposits should be restricted to provisions of geologic and other scientific data."

Chief petroleum point in the Hoover commission's recommendation for Department of Interior changes was the formation of a mineral resources service, consisting of the following federal agencies or services:

1. Bureau of Mines.
2. Geological Survey.
3. Oil and Gas Division.
4. Administration of mineral leases.
5. Leasing of mineral lands.
6. Investigations of natural gas resources.
7. Advisory service on minerals for federal agencies.

The Hoover commission proposes that the authority for investigation of natural gas resources be removed from the Federal Power Commission. Leasing of mineral lands would be removed from the Department of Agriculture.

Reasons for the proposed changes were: (1) To co-ordinate policies; (2) to eliminate costly overlaps, and (3) to promote more energetic development.

Said the commission: "We have need for more extensive geological explorations, for more research into improved methods of (oil) recovery, for more adequate management of the government relations to title leases, royalties, reservations, etc."

More of a departure from the present governmental setup was the recommendation made in a separate report signed by Dean Acheson, commission vice chairman and now Secretary of State, and two commissioners. They proposed creating a Department of Natural Resources to replace the Interior Department. In their department would go the Bureau of Mines, the Oil and Gas Division and the Geological Survey.

James Forrestal, commission member and outgoing Secretary of the Department of Defense, wrote the single dissent, which was consistent with his sponsorship of a bill calling for federal control of the tidelands.

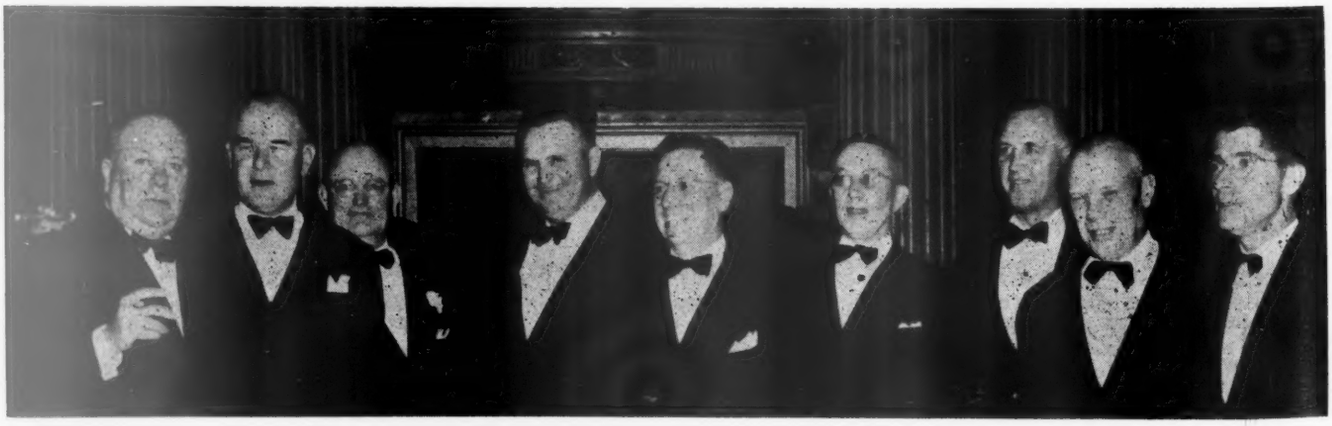
Research Project

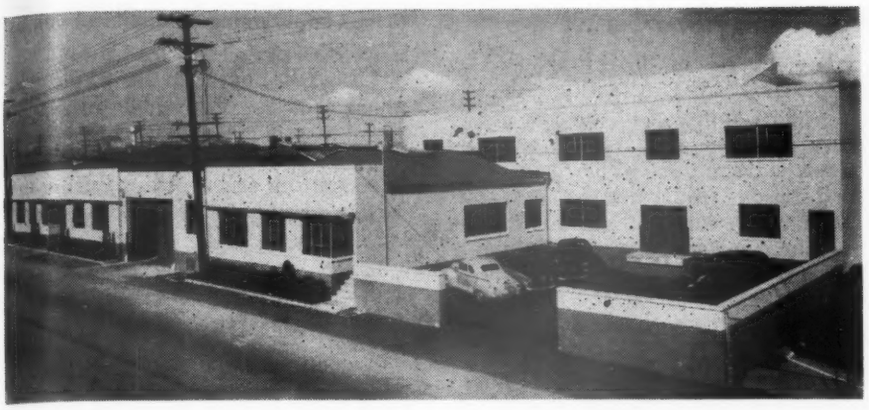
The Pennsylvania Grade Crude Oil Association has renewed its crude oil production research agreement with Armour Research Foundation, Chicago, Illinois, calling for an expenditure of about $20,000 in 1949.

The research project embraces a fundamental study of the mechanisms by which so-called "wetting agents" might be used to increase the recovery of petroleum by a water flooding process. The objective is to select an agent which is sufficiently efficient and economical for use by oil producers.

Such an improvement, Association officials said, would be particularly applicable to secondary recovery oil fields of the country where underground water floods are used to drive petroleum to producing wells.

Nomads. Officers and directors of Los Angeles, California, Chapter of Nomads are: Bob Eiche, regent; Fred Ripley, past president; Ted Forsythe, deputy sergeant-at-arms; Tommy Johnston, sergeant-at-arms; Lee Laird, president; Earle Boggess, vice president, Jerry Engstrand, Bud Landis, past secretary; Knight Templeton, assistant treasurer.





American Recording Chart Company buildings.

ARCCO Facilities Completed

New construction at American Recording Chart Company, Los Angeles, now gives the laboratory and manufacturing departments over 23,000 sq ft of air conditioned floor space for the highly precision work of making Arcco scientific instruments.

New plant layout on the assembly line plan aids production of Arcco liquid and gas recording gravitometers, gas balances, meters and chart pens. A special section of the new plant is devoted to the manufacture and testing of the Arcco-Anubis recording controlling liquid gravitometer. Another portion of the plant houses the chart printing division, also completely air conditioned to maintain exact control over materials and processes. According to James W. Dunn, general manager, separate humidified rooms were built for inspection as well as for storage of chart master plates and of over 6,000,000 charts for the various industries served.

Shell Fellowship Program

The graduate Fellowship Program established by Shell Union Oil Corporation and its associated companies in the United States will be continued through the 1949-50 academic year, the Shell Fellowship Committee has announced. Designed to aid deserving students toward advanced degrees in scientific and technical fields, the program embraces 44 fellowships.

Hose Used on Diesels

A new use for rubber hydraulic control hose on large Diesel powered trucks is reported by The B. F. Goodrich Company, Akron, Ohio.

Hose manufactured by the company is being successfully used on the fuel injection systems of the Diesels. It replaces copper or flexible metallic tubing ordinarily used for this purpose, which often has the disadvantage of breaking off behind the couplings, caused by vibration.

New Socony-Vacuum Company

A new company known as Socony-Vacuum Francaise has been formed with headquarters at 46 Rue de Courcelles, Paris, France. Socony-Vacuum Francaise results from a merger of three wholly or partially owned Socony-Vacuum companies.

Shipments to Norway

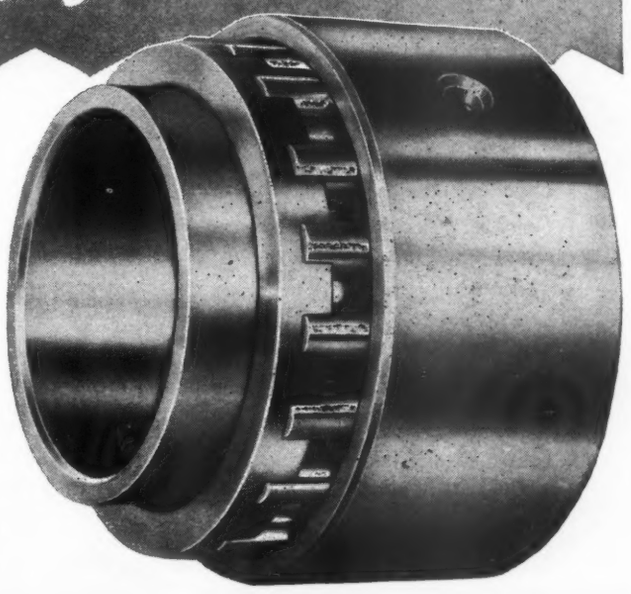
Shipments of $2,031,000 worth of crude oil and petroleum products to Norway were approved for financing by the Economic Cooperation Administration. Seventy-five per cent of the oil will be bought in Latin America, the rest in this country.

American

"Extra" Heavy-Duty

Roller Bearings

for the toughest anti-Friction jobs



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Burma Proffers Aid

The government of Burma has proposed a partnership with financial aid to the Burmah Oil Company to help reconstruct the national oil industry, it has been reported by Reuter. Negotiations now taking place between the Government and the company hinge on the financial aspects of this reconstruction program. In view of the Government's own monetary difficulties any financial plan will presumably depend on Burma securing a foreign loan. The Burmah Oil Company's post-war reconstruction program has been halted by insurrection.

API Vetos "Self-Serve"

The board of directors of the American Petroleum Institute has expressed disapproval of the new "self-serve" gasoline stations in a recently adopted resolution which held that such stations jeopardize the "enviable record of fire safety at 1,500,000 gasoline pumps where 25,000,000 automotive vehicles are fueled daily with 97,000,000 gallons of gasoline."

"Self-serve" stations originated in Los Angeles County, California, in May, 1947. As the name implies, motorists handle the pumps themselves while attendants collect the purchase prices, supervising a number of pumps simultaneously.

The API board, in its resolution, noted that the flammable nature of gasoline vapor necessitates the use of every practicable precaution to minimize spilling and overflow during the fueling of automotive vehicles at service stations.

Argentina Seeks to Cut Oil Imports from U. S.

Argentina is making efforts to switch oil imports from the United States to the Middle East, authoritative diplomatic sources have reported.

These sources said Argentina had been pledged to use a substantial portion of its dollar income from exports to the United States for paying off frozen letters of credit owed to U. S. banks and exporters. The amount of money involved is estimated at $250,000,000.

By reducing its imports of oil and other products from the United States, it was said, Argentina would have more dollars to apply to the debt.

Norris Opens Casper Branch

W. C. Norris, Manufacturer, Inc., announces opening of a new branch at Casper, Wyoming, to enable its jobbers to better serve the Rocky Mountain and Western Canada areas. The new Casper branch will be under the supervision of LeRoy Mitchell.

Operations in Saudi Arabia

Crude oil production in Saudi Arabia during February amounted to 14,903,899 bbl, or an average of 532,282 bbl per calendar day, it was announced by the Arabian American Oil Company.

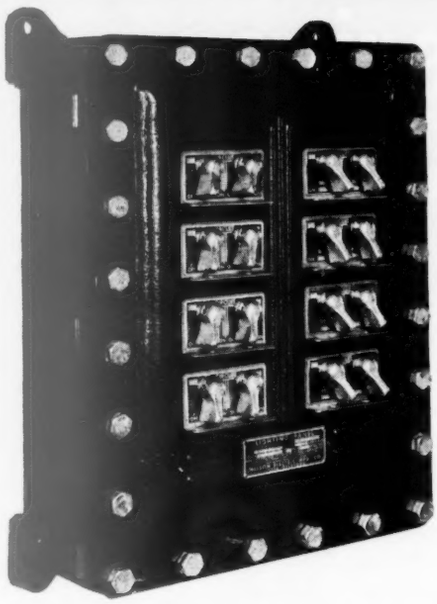
Crude processed at the company's refinery at Ras Tanura amounted to 4,173,314 bbl, or an average of 149,047 bbl per calendar day .

Crude oil production for the first two months of 1949 amounted to 31,144,251 bbl, averaging 527,869 bbl daily. Crude run in the refinery for the same period was 7,677,370 bbl, an average of 130,125 bbl per calendar day.

Tube-Turn Distributor

The A. B. Judd Supply Company of Houston, Texas, has been appointed a distributor of Tube-Turn welding fittings and flanges, it is announced by John G. Seiler, executive vice president of Tube Turns, Inc. A. B. Judd, president of the recently established firm that bears his name, was president of the Republic Supply Company of Houston until he resigned in 1948 to set up his own organization.

Highly Endorsed by Engineers and Field Men!



At left is shown Nelson Class 411 Explosion Proof Lighting Panel—16 circuit enclosure, single pole.

Designed to provide branch circuit protection for electrical circuits in hazardous locations, the Nelson Explosion Proof Lighting Panel offers a number of features that are highly endorsed by engineers and field men. Among these features are—

- Excellent Design. Compact in size, yet having ample wiring space.
- Quicklag Circuit Breakers provide faster opening action on short circuits, and full time delay on overloads. Additional breakers can easily be added in the field.
- Several conduit combinations are available; and many single pole circuit combinations.
- Corrosion-resisting operating shafts and mechanism.
- Two sizes of enclosures—8 and 16 circuits, single pole.
- Designed for Class 1, Group D Hazardous Locations. Can also be used in Class 2, Groups E, F and G, and Class 4 Locations. Write for Bulletin 411.

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General Petroleum's New Home

A new address in Los Angeles—612 South Flower Street— will soon gain increasing importance in the oil industry as 30 oil industry firms move into the new General Petroleum Building at that location.

Eight of the building's 13 floors will be occupied by the Home Office of the General Petroleum Corporation. Much of the remaining five floors will be occupied by oil industry organizations or firms closely connected with the oil industry.

A six-story garage, which consists of a gently rising enclosed spiral ramp, will provide parking facilities for the new building.

Mexican Officials Discuss Oil Loan Possibilities

Senator Antonio Bermudez, director of Petroleos Mexicanos, has been discussing informally with officials of the Export-Import Bank the possibilities of obtaining a loan for Mexico's oil industry. The size of the loan has not been reported, but the figure $475,000,000 suggested last year by the House interstate and foreign commerce committee has received Bermudez' approval.

Opposition to the loan is based on the grounds that the bank may not be authorized to finance exploratory projects of the type Pemex is proposing and that official American aid should not be given to a government monopoly. American private capital can engage in exploration and development if willing to accept government terms.

Syria Grants Concession

The Syrian government has agreed to grant a 70-year oil concession to an independent American operator, Syrian-born, James W. Menhall of Benton, Illinois. The announcement was made in *The Oil Forum* by B. Orchard Lisle, joint editor-publisher, who has just returned from the Middle East.

The deal, covering about 22,100 sq mi, involves no "bonus" down payment, but has stipulations requiring more intensive exploratory drilling than involved in previous concessions.

In addition to grant of development rights, the Syrian government has given guarantees to Menhall that the five new pipe lines planned by other companies to cross Syrian territory will be required to make available up to 30 per cent of their capacity as common carriers for Syrian oil.

Royalty called for in the concession is one-eighth of production, with option for the government to accept the market value or a minimum of 34 cents per barrel gross production, whichever may be larger.

Menhall, owner of the J. W. Menhall Drilling Company of Benton, currently has about 80 wells and 1300 barrels per day production in Illinois, Kentucky, and Louisiana. He is registering The Syrian-American Oil and Gas Company, S.A.S. in Damascus to operate the concession, and its $100,000,000 authorized capital is to be opened for simultaneous private subcription on an equitable basis with both U. S. and Syrian participants. He has six drilling rigs available for the project, the first of which is being prepared for shipment to Syria.

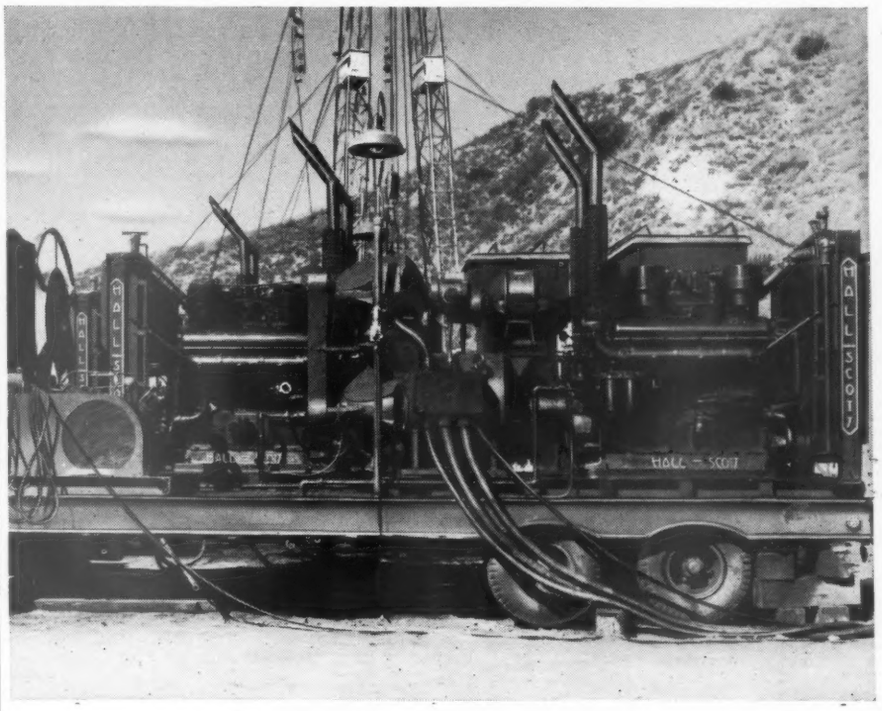
Natural Gas Sales at Peak

Gas sales in 1948 surpassed the record high estimates of the nation's producers, the American Gas Association has reported.

The unexpected gain was shown in the first official compilation of fourth quarter figures for last year. The gain was made despite a milder winter.

Sales of natural gas last year reached 2822 billion cubic feet, about 20 billion cubic feet above the 1948 year-end estimate, and well above the 2515 billion cubic feet of 1947.

Manufactured gas sales hit 446 billion cubic feet, compared with 434 billion in 1947.



SHELL SELECTED

HALL-SCOTT ENGINES

for revolutionary new Electric Drilling Rig

Three Hall-Scott V-12 Engines, each driving a 200-kw generator, contribute directly to the success of Shell Oil Company's new 10,000-foot electric drilling rig—the first completely mobile 900 h.p. rig.

Sturdy in construction, these engines are so compact in design . . . so light in weight for power delivered . . . that engines, generators and special gear can be mounted on two trailers. Result: *unprecedented mobility* and substantial savings in transportation costs.

These engines have a rating of 300 h.p. at 75 B.M.E.P. for drilling and mud pump service, with an intermittent rating up to 500 h.p. for hoisting.

Other Hall-Scott engines, in various sizes, are powering draw works, pumps, generators and industrial equipment for many of the industry's leading producers. Their excellent power-to-weight ratio and rugged construction bring real economy in maintenance and production costs. Complete data and prices on request.

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UNITED STATES PETROLEUM IMPORTS AND EXPORTS SITUATION

(Thousands of Barrels)

Year	Crude oil imports	Refined oils imports	Total imports	Crude oil exports	Refined oils exports	Total exports	Total imports per cent of exports	U. S. crude production	Crude imports per cent of crude production	Total imports per cent of crude production	U. S. refinery runs	Crude imports per cent of refinery runs	Refined imports per cent of refinery runs	Total demand all oils	Total imports per cent of demand	Total exports per cent of demand
1918	37,736	1,227	38,963	5,884	62,128	68,012	57.3	355,928	10.6	10.9	326,025	11.6	0.4	432,600 ®	9.0	15.7
1919	52,822	1,376	54,198	6,348	57,500	63,848	84.9	378,367	14.0	14.3	361,520	14.6	0.4	438,434	12.4	14.6
1920	106,175	2,647	108,822	9,295	70,281	79,576	136.8	442,929	24.0	24.6	433,915	24.5	0.6	535,382	20.3	14.9
1921	125,364	3,428	128,792	9,627	62,025	71,652	179.7	472,183	26.5	27.3	443,363	28.3	0.8	529,402	24.3	13.5
1922	127,308	8,665	135,973	10,805	63,539	74,344	182.9	557,531	22.8	24.4	500,706	25.4	1.7	605,540	22.5	12.3
1923	82,015	17,638	99,653	17,534	84,447	101,981	97.7	732,407	11.2	13.6	581,238	14.1	3.0	754,361	13.2	13.5
1924	77,775	16,806	94,581	18,239	98,905	117,144	80.7	713,940	10.9	13.2	643,719	12.1	2.6	805,070	11.7	14.6
1925	61,824	16,376	78,200	13,337	100,497	113,834	68.7	763,743	8.1	10.2	739,920	8.4	2.2	840,818	9.3	13.5
1926	60,382	20,938	81,320	15,407	116,543	131,950	61.6	770,874	7.8	10.5	779,264	7.7	2.7	912,893	8.9	14.5
1927	58,383	13,353	71,736	15,844	125,805	141,649	50.6	901,129	6.5	8.0	828,835	7.0	1.6	944,762	7.6	15.0
1928	79,767	11,790	91,557	18,966	135,483	154,449	59.3	901,474	8.8	10.2	913,295	8.7	1.3	1,014,716	9.0	15.2
1929	78,933	29,777	108,710	26,401	135,925	162,326	67.0	1,007,323	7.8	10.8	987,708	8.0	3.0	1,103,203	9.9	14.7
1930	62,129	43,489	105,618	23,705	131,732	155,437	67.9	898,011	6.9	11.8	927,447	6.7	4.7	1,083,511	9.7	14.3
1931	47,250	38,837	86,087	25,535	98,338	123,873	69.5	851,081	5.6	10.1	894,608	5.3	4.3	1,027,274	8.4	12.1
1932	44,682	29,812	74,494	27,393	75,805	103,198	72.2	785,159	5.7	9.5	819,997	5.4	3.6	938,757	7.9	11.0
1933	31,893	13,501	45,394	36,584	69,942	106,526	42.6	905,656	3.5	5.0	861,254	3.7	1.6	975,214	4.7	10.9
1934	35,558	14,936	50,494	41,127	73,149	114,276	44.2	908,065	3.9	5.6	895,636	4.0	1.7	1,034,672	4.9	11.0
1935	32,239	20,396	52,635	51,430	77,557	128,987	40.8	996,596	3.2	5.3	965,790	3.3	2.1	1,112,672	4.7	11.6
1936	32,327	24,777	57,104	50,313	81,681	131,994	43.3	1,099,687	2.9	5.2	1,068,570	3.0	2.3	1,224,748	4.7	10.8
1937	27,484	29,673	57,157	67,234	105,600	172,834	33.1	1,279,160	2.1	4.5	1,183,440	2.3	2.5	1,342,516	4.3	12.9
1938	26,412	27,896	54,308	77,254	116,474	193,728	28.0	1,214,355	2.2	4.5	1,165,015	2.3	2.4	1,330,851	4.1	14.6
1939	33,095	25,965	59,060	72,076	116,883	188,959	31.3	1,264,962	2.6	4.7	1,237,840	2.7	2.1	1,420,035	4.2	13.3
1940	42,662	41,089	83,751	51,496	78,970	130,466	64.2	1,353,214	3.2	6.2	1,294,162	3.3	3.2	1,457,086	5.7	9.0
1941	50,606	46,536	97,142	33,238	75,592	108,830	89.3	1,402,228	3.6	6.9	1,409,192	3.6	3.3	1,594,609	6.1	6.8
1942	12,297	23,669	35,966	33,834	83,073	116,907	30.8	1,386,645	0.9	2.6	1,334,103	0.9	1.8	1,566,815	2.3	7.5
1943	13,833	49,579	63,412	41,342	108,615	149,957	42.3	1,505,613	0.9	4.2	1,429,738	1.0	3.5	1,671,383	3.8	9.0
1944	44,805	47,506	92,311	34,238	173,378	207,616	44.5	1,677,904	2.7	5.5	1,665,684	2.7	2.9	1,878,879	4.9	11.0
1945	74,337	39,282	113,619	32,998	149,985	182,983	62.1	1,713,655	4.3	6.6	1,719,534	4.3	2.8	1,955,668	5.8	9.4
1946	86,066	51,610	137,676	42,436	110,687	153,123	89.9	1,733,939	5.0	7.9	1,730,197	5.0	3.0	1,945,909	7.1	7.9
1947	97,532	61,857	159,389	46,355	118,122	164,477	96.9	1,856,987	5.3	8.6	1,852,246	5.3	3.3	2,154,280	7.4	7.6
1948	129,093	58,616	187,709	39,840	95,114	134,954	139.1	2,016,282	6.4	9.3	2,030,670	6.4	2.9	2,243,326	8.4	6.0

Source: U. S. Bureau of Mines and "Statistical Bulletin," American Petroleum Institute.

From The Petroleum Data Book, Second Edition, which carries 750 pages of information on the petroleum industry.

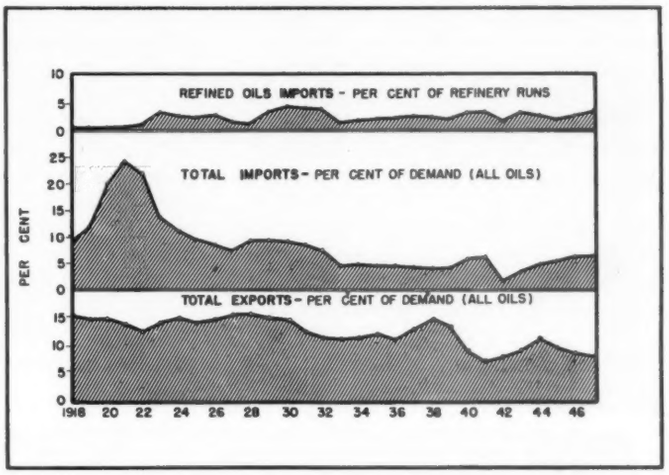
U. S. IMPORTS AND EXPORTS

Foreign Trade Balance (Daily Average)

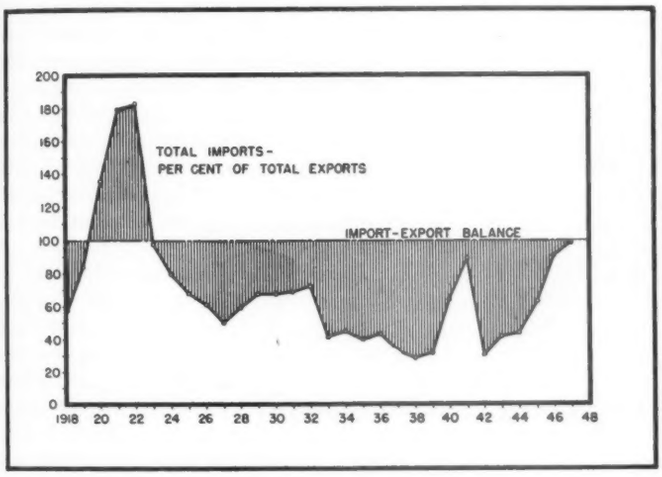
	Total imports	Total exports	Balance
1922	373,000	204,000	+169,000
1941	266,000	298,000	+ 32,000
1945	311,000	501,000	+190,000
1946	377,000	420,000	+ 43,000
1947	437,000	451,000	+ 14,000

Source of 1947 Imports (Daily Average)

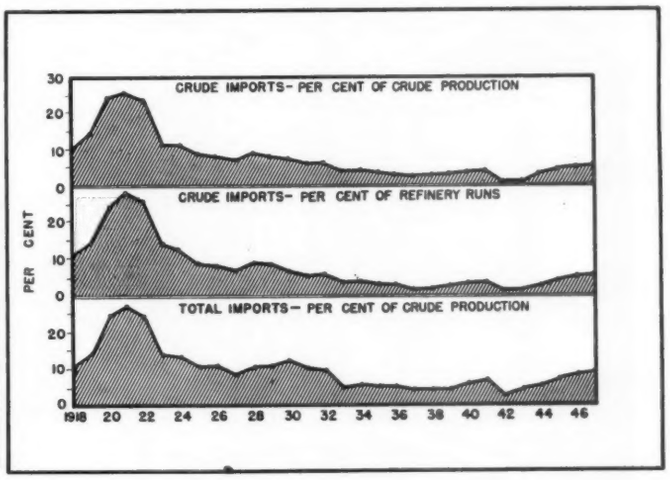
From	Crude and products	Per cent
Caribbean and South America	397,000	90.8
Mexico	30,000	6.8
Middle East	8,000	1.8
Canada and others	2,000	0.6
Total imports	437,000	100.0


REFINED OILS IMPORTS - PER CENT OF REFINERY RUNS
TOTAL IMPORTS - PER CENT OF DEMAND (ALL OILS)
TOTAL EXPORTS - PER CENT OF DEMAND (ALL OILS)
PER CENT
1918 20 22 24 26 28 30 32 34 36 38 40 42 44 46

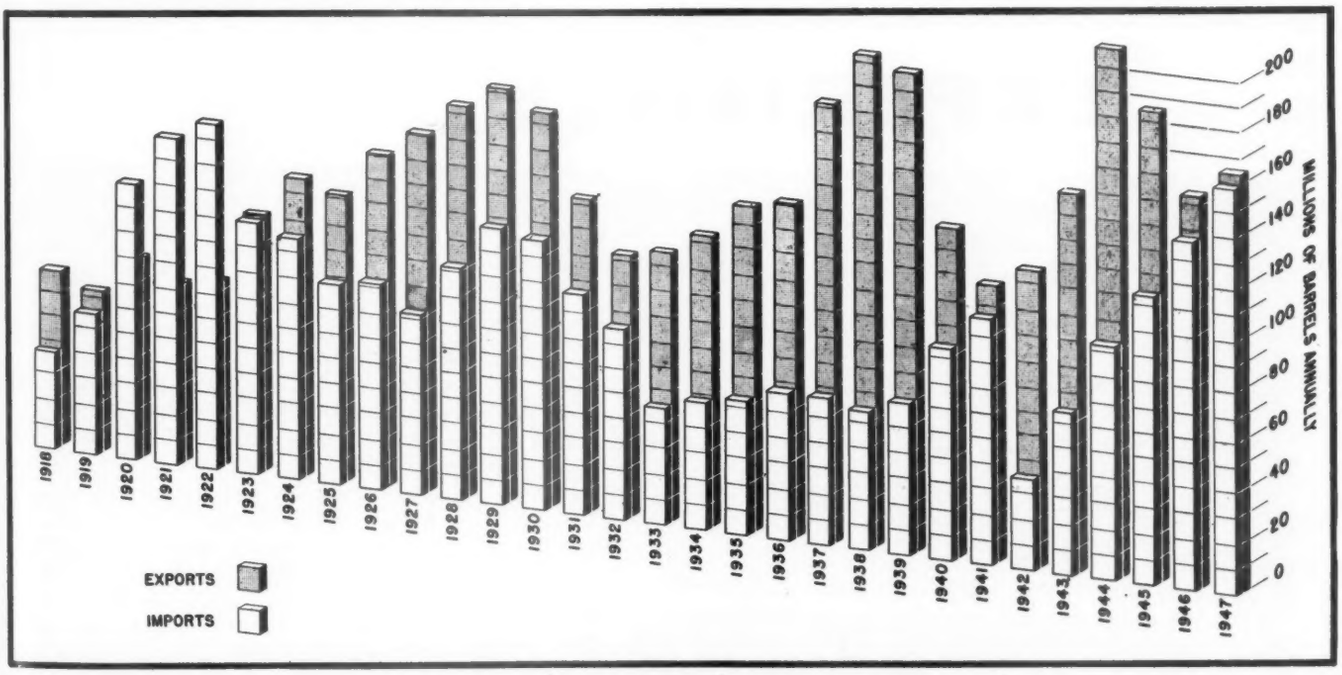
Increasing Foreign Supply



Dwindling Foreign Trade Balance


CRUDE IMPORTS - PER CENT OF CRUDE PRODUCTION
CRUDE IMPORTS - PER CENT OF REFINERY RUNS
TOTAL IMPORTS - PER CENT OF CRUDE PRODUCTION
PER CENT
1918 20 22 24 26 28 30 32 34 36 38 40 42 44 46

Greatest Ratio Since 1932



Imports Will Exceed Exports in 1948

From The Petroleum Data Book, Second Edition, which carries 750 pages of information on the petroleum industry.

From The Petroleum Data Book, Second Edition, which carries 750 pages of information on the petroleum industry.

Mason-Neilan Demonstrator On Nation-Wide Tour

Mason-Neilan Regulator Company's new demonstrator is touring the nation, first through the Southern states, then through the Southwestern and Pacific Coast states, returning east by the Rocky Mountain and Central states to New England.

The demonstrator is designed to show instrument engineers and operating personnel a cross section of Mason-Neilan control equipment. The demonstrator has two side panels that swing out, and, with the the rear section, form a display 20 ft wide.

Military Believes Western Hemisphere Oil Sufficient

Undersecretary of the Navy W. John Kenney, spokesman for the military in petroleum matters, has in effect expressed the opinion that supplies of Western Hemisphere petroleum would suffice in another period of emergency, if supplemented by severe rationing. This stand reverses previous statements coming from the Department of Defense in support of the synthetic fuels program.

The opinion appeared in a letter to the House foreign affairs committee, who had requested it.

Tulsa AIChE Meeting

The American Institute of Chemical Engineers meets in Tulsa, Oklahoma, May 9-11. Among the papers to be presented are: "Liquid Fuels for Energy Supply" by E. V. Murphree, E. J. Gohr, and F. T. Barr, Standard Oil Development Company, New York; "The Role of Physics and Chemistry in Petroleum Reservoir Mechanics Research and Practice" by L. E. Elkins, Stanolind Oil and Gas Company, Tulsa; "Economic Analysis in Petroleum Refining" by J. P. Hamilton, Humble Oil and Refining Company, Houston; and "Optimum Propane Recovery in Natural Gasoline Plants" by B. M. Holt, Ralph M. Parsons Company, Los Angeles.

Firms Join Forces

Of interest in the water conditioning field is the recent announcement that two old-timer Illinois firms, Elgin Softener Corporation, Elgin, and Illinois Water Treatment Company, Rockford, have joined forces. The management states that through consolidating manufacturing operations, production economies are being accomplished which can be passed on to the user.

The already comprehensive line of Elgin zeolite softeners, filters, water treating chemical, and boiler and process water conditioning systems will be supplemented by the Illco-Way products, and fully rounded out by the addition of Illco-Way de-ionizers, de-alkalizers, de-mineralizers and special ion-exchangers."

A Wearin' of the Green!

Shure, and 'tis the Shamrock Drilling Company that we're talking about. What could be more appropriate for Seventeenth of March?

On St. Patrick's Day six years ago, those two Irishmen, George H. McCarthy and Jerome J. O'Brien incorporated their drilling company. Efficient operations and square shooting have earned an enviable reputation and the respect of the industry as a whole. All of which makes them very proud.

While Jerry is now in Texas lending his talents to the Jergins Oil Company, Mac carries on here in California. He has three drilling rigs now running. One for Robert S. Lytle at West Mountain, one for the Standard Oil Company at Puente, and one for the Union Pacific at Wilmington. They also operate the Shamrock Oil Well Service Company, contracting with the Standard Oil Company for the Navy, doing remedial work at Elk Hills Naval Reserve. Two additional service rigs are running in Kern County.

EXPERIENCE

is essential in the drilling of an oil well. And, it is of equal importance when it comes to *oil financing* — the reason for Republic being selected by an increasing number of oil men to handle their financial requirements.

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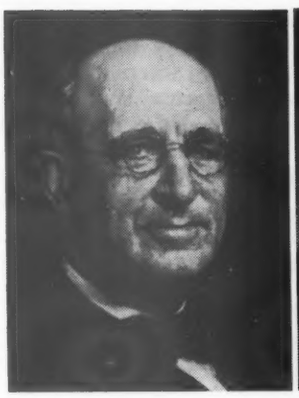


Frank Phillips

F. W. Mayer

H. H. Brereton

▸ **Frank Phillips,** chairman of Phillips Petroleum Company, has announced his wish to be relieved of active management responsibilities in the company which bears his name and which he founded in 1917.

Shortly after receipt of Phillips' request, members of the board of directors expressed their intention to discontinue the office of chairman of the board and to create for Phillips the new title of honorary director and honorary chairman, without voting or management responsibilities. These actions would be taken at the directors meeting immediately following the stockholders meeting.

▸ A three-day conference, bringing together all Division Managers of Rockwell Manufacturing Company was held at the Schenley Hotel, Pittsburgh, Pennsylvania. The meeting's theme encompassed plant operating statements and annual budgets as tools of operating management.

Thirty members of the firm attended, including: W. F. Rockwell, chairman of the board; W. F. Rockwell, Jr., president; L. A. Dixon, A. J. Kerr, J. E. Ashman, W. H. Newbaker, E. W. Meyers, W. S. Potter, C. A. Wiken, M. J. Carl, C. S. Bygate, W. H. Marsh, E. F. Foubert, H. C. Greene, Munroe Corbin, R. G. Caouette, and S. W. Brown of Pittsburgh. A. R. Whittaker, National Meter, Brooklyn; H. F. Zorn, V & O Press, Hudson, New York; W. R. Brown, Arcade Manufacturing, Freeport, Illinois; R. C. DuBrucq, Crescent Machine, Leetonia, Ohio; F. V. Snodgrass, Nordstrom Valve, Oakland; H. C. Stuckeman, R. P. Melius, Delta Manufacturing, Milwaukee; W. F. Crawford, W. A. Marsteller, Edward Valves, East Chicago, Indiana; H. S. Rockwell, Hopewell Division, Hopewell, New Jersey; H. F. Sacknus, Red Star Products, Norwalk, Ohio; L. W. Heavner, Macnick Division, Tulsa; L. A. Dixon, Jr., Pittsburgh DuBois, DuBois, Pennsylvania.

▸ **Guy Tate,** vice president of Magnolia Petroleum Company, was elected chairman of the Gulf-Southwest Oil Industry Information Committee, which administers the industry's informational program in New Mexico, Texas, Arkansas, Louisiana, Mississippi, and Alabama. Tate succeeded Fred F. Murray, Oil Well Supply Company president, who resigned after two years of service.

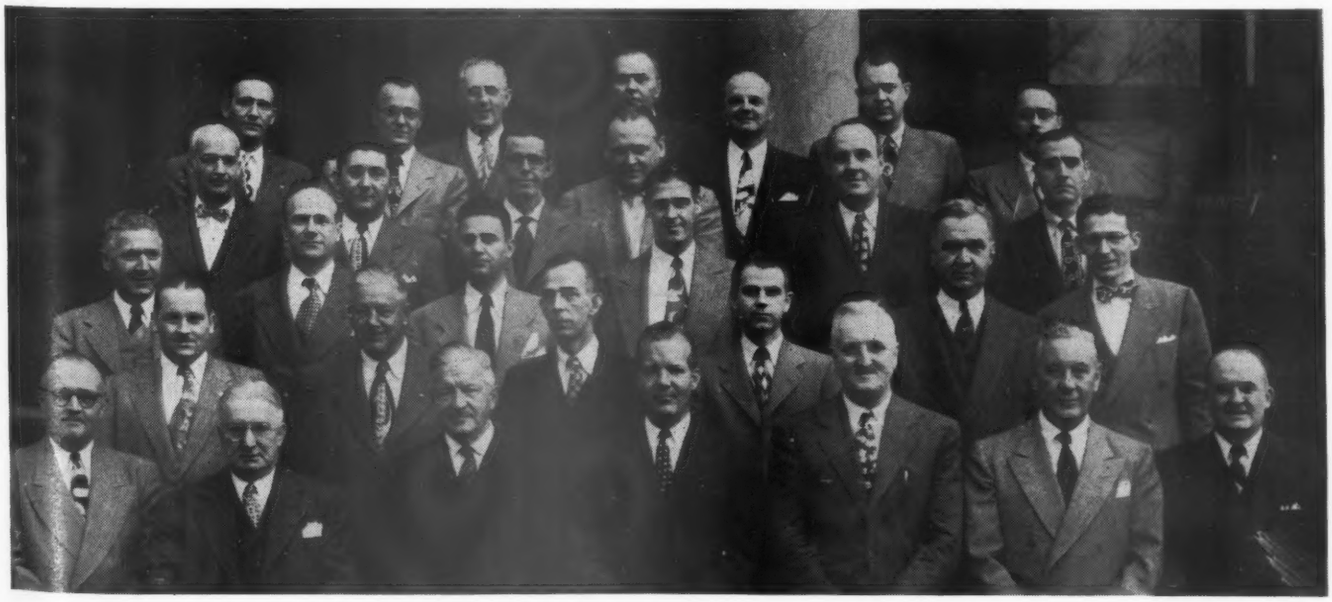
Named as vice chairmen of the district committee were John P. Morgan, Sun Oil Company, Dallas, and C. J. Guzzo, Gulf Refining, New Orleans.

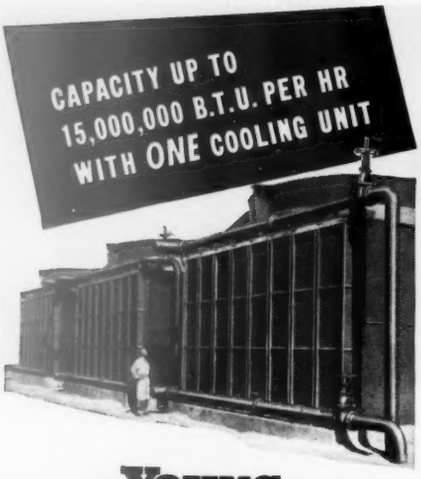
▸ **H. H. Brereton** and **F. W. Mayer** have been appointed vice presidents of two East Coast wholly-owned subsidiaries of the Standard Oil Company of California. Brereton has been named a vice president of The California Oil Company, according to E. W. Endter, president, and Mayer has been made a vice president of the California Refining Company, according to C. E. Allen, president.

Brereton, who has been with California Standard and its subsidiaries for 28 years, started his career in the company's sales department at Los Angeles. Later he was transferred to Standard Stations, Inc., as assistant to the general manager. He is also secretary and treasurer of The California Oil Company.

Mayer has worked for California Standard and its subsidiaries for 35 years, largely in positions concerned with manufacturing and finance. He has been secretary and treasurer of the California Refining Company since its organization in July, 1946.

Rockwell Division managers have conference in Pittsburgh.





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- Available with round tube cores for pressure operation or flat tubes for extreme cooling efficiency.

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▸ **Ralph L. Nuttall** has been appointed to the staff of the National Bureau of Standard, where he will do research on the thermal conductivity of gases at elevated temperatures and pressures in the thermodynamics lab.

▸ **Lee J. Laird** has been appointed manager of Howard Supply Company's mechanical rubber goods division. President of the Los Angeles chapter of the Nomads and a popular member of the Petroleum Production Pioneers, Laird has held various managerial positions in the Chiksan Company for the past 14 years.

▸ **Willard H. Dow,** president of the Dow Chemical Company, his wife and three other persons were killed March 31 when a company plane, carrying them to Boston for Winston Churchill's speech, crashed and burned.

▸ **Don P. Aikin** has been named plant foreman at Stanolind Oil and Gas Company's Superior refinery, Vivian, Louisiana. Aikin was formerly doing chemical engineering work at the refinery.

▸ **Lawrence R. Alley** has been appointed assistant executive secretary of the Interstate Oil Compact Commission. For the past 14 years he has been an employe of the Corporation Commission of Oklahoma.

▸ **R. F. Bradley** has been appointed service engineer—well drills, at the Englewood, New Jersey, office of Bucyrus-Erie Company, South Milwaukee, Wisconsin.

W. J. Cameron has become representative—well drill sales of Bucyrus-Erie. Previously, he represented the company as service engineer attached to the Dallas office. Stepping into the service engineer vacancy left by Cameron is **W. S. Clark,** formerly associated with Atwood and Clark, drilling contractors of Kermit, Texas.

▸ **Tom E. Ward,** president, Oilfield Equipment Company, Inc., New York, reports he had a good visit in Brazil and in the Argentine and is now on the way to Trinidad and Cuba.

▸ **Clifford B. Marshall** has been elected to the board of directors of Standard-Vacuum Oil Company, P. W. Parker, chairman of the board, has announced. A veteran of 29 years oil industry experience, Marshall has been general manager of Standard-Vacuum's India division, including also Pakistan, Burma, and Ceylon, since 1944. During World War II, as assistant division general manager, he was instrumental in Stanvac's efforts to furnish high-octane gasoline and petroleum products to United States and Allied armed forces in the CBI Theater. Marshall has been succeeded by **Rufus T. Burton,** who has had lengthy service in the India division.

▸ **Joseph Jensen,** chief petroleum engineer of the Western Division of the Tide Water Associated Oil Company, was recently elected chairman of the board of directors of the Metropolitan Water District for a term of two years. The Metropolitan Water District embraces most of the cities in Los Angeles, Orange, and San Diego counties and supplies water from the Colorado River through the Colorado River Aqueduct.

▸ **J. E. Everroad,** recently elected president and general manager of Cummins Sales and Service, Inc., has appointed **Richard Keast** sales engineer to handle the sales of Cummins diesel engines from the Dallas office in the Magnolia Building.

▸ **Emory N. Kemler,** a widely known research and production engineer in petroleum and other fields, has been appointed associate director of Southwest Research Institute in Houston, according to an announcement by the Institute's governor-trustees and Harold Vagtborg, president.

Kemler, who succeeds **John V. Pennington,** on leave of absence from the Institute to direct the Drilling Research, Inc., program begun last month, resigned the post of acting director of research for New York University to administer the Institute's program in Houston. He has taken over the Institute's Oil and Gas Building offices and will be active in the development of its Houston laboratory facilities.

▸ **Robert W. Schramm,** formerly with Carbide and Chemical Corporation, has joined Spencer Chemical Company's market research staff with headquarters at 610 Dwight Building, Kansas City, Missouri.

▸ **Paul G. Hoffman,** Economic Cooperation Administrator, has named a group of consultants to investigate and analyze factors that should be considered in determining competitive prices on shipments of Middle East oil financed by ECA. Pricing problems arise from increasing quantities of oil that have become available in the Middle East. The group will advise ECA with respect to current price levels, considering the growing supplies.

Consultants appointed are: Max Ball, oil and gas consultant, Washington, D. C.; Edward S. Mason, dean of the graduate school of business administration, Harvard University; Sumner Pike, commissioner, Atomic Energy Commission, Washington, D. C.; George W. Stocking, professor of economics, Vanderbilt University, Nashville, Tennessee; and L. S. Wescoat, president, Pure Oil Company.

Ross Sterling, Texas governor in the depression years of 1931-32, died March 25. Sterling has been called the father of legislation giving the Railroad Commission oil proration authority. He was the organizer of Humble Oil and Refining Company, serving as first president when the company's capitalization was $4,000,000. When he resigned as chairman of the board in 1925, the capitalization had grown to $75,000,000. He organized the Sterling Oil and Refining Company in 1933 and served as its president until 1946 when he became chairman of the board.

Merton Keel, who was formerly connected with Walter Weir, Inc., advertising agency, New York, has joined Shell Chemical Corporation as senior technologist in the marketing operations department of the New York head office. He is a graduate of the University of Alberta in Canada, where he received a B.S.C. degree. He also holds an M.S. in organic chemistry and biochemistry from the University of Michigan. Before joining the Walter Weir agency, where he worked on the M. W. Kellogg account, he was connected with the Aluminum Company of Canada and Dow Chemical Company.

David R. Salmon has joined the staff of the Oil Industry Information Committee in New York as educational coordinator. He was director of education and industry for the National Association of Manufacturers immediately prior to his affiliation with the OIIC. He will work primarily with the OIIC's Youth and Education Subcommittee and will function as liaison man between the Institute and the nation's educators.

Lyman R. Brown, 48, research associate in the Technical Service Department, Socony-Vacuum Laboratories, Brooklyn, New York, died suddenly of a heart attact on March 22. He had been a member of the Socony-Vacuum organization for 21 years.

Paul G. Brown has joined the staff of the Western Oil and Gas Association as technical secretary.

O. N. Stevens has retired as operating vice president of Southern Alkali Corporation after having been associated with the alkali industry since 1907 and with the Columbia Chemical Division of Pittsburgh Plate Glass Company for the past 26 years.

Stanley J. Hultman, superintendent of the two-year old Lake Charles, Louisiana, plant has been named works manager at Corpus Christi, Texas.

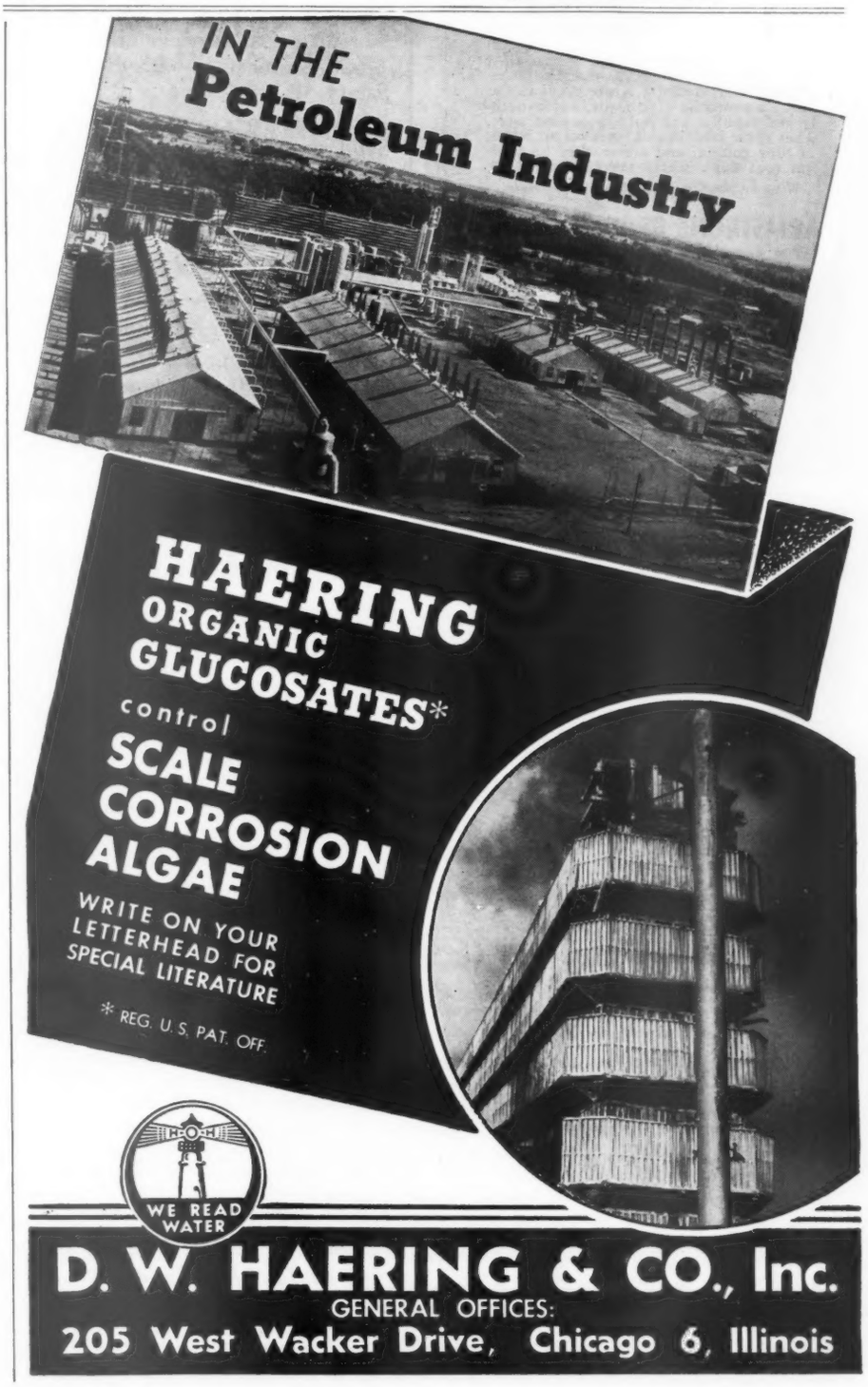
Charles E. Weeks, associated with the Texas operation since 1934 as auditor and for the past two years as assistant to Stevens, has been named assistant works manager at Corpus Christi.

C. K. Ballard, superintendent of the caustic and chlorine department at Lake Charles since 1946, has been named plant superintendent.

Other appointments at Lake Charles include **Alvin T. Raetzsch** as superintendent of operations and **Frank W. Woodman** as superintendent of engineering. **Russell S. Clark** has been appointed divisional power engineer at Lake Charles.

Fred W. (Pete) Wallace, formerly vice president, sales manager, and columnist of *Drilling* magazine, has severed his connection with this publication. He has sold his stock in Associated Publishers, Inc., to the president of the company, Ted W. Mayborn. Wallace' plans for the future are indefinite.

A. C. Hultgren, traffic manager of Shell Oil Company for territory east of the Rockies since 1935, has retired after 21 years with the company. He is succeeded by **C. H. Wager,** who has been assistant manager of the traffic department since 1940.



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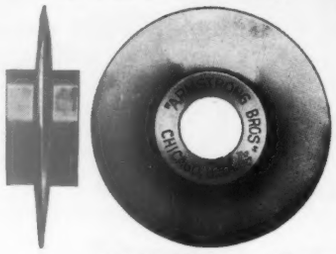

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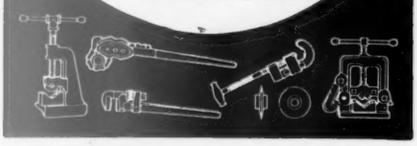

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Oil field distributors for Wisconsin Engines and all types of utility units.

Shell Makes West Coast Plans

Shell Oil Company directors meeting in San Francisco have approved a $33,000,000 capital budget to be invested this year in Pacific Coast territory. H. S. M. Burns, president, said the funds would be used in oil exploration, in enlarging terminals, building new service stations, expanding distribution facilities; also for research on fuels, lubricants, and chemicals.

Petroleum Reserves Under the Sea

Most petroleum geologists have known for many years that salt dome type structures favorable for the accumulation of oil and gas existed in the submerged lands off the coasts of Texas and Louisiana. For many good reasons, however, only a few of these structures were mapped by geophysics and only four or five were drilled in 1944.

Late in that year, Magnolia Petroleum Company launched a multi-million dollar geophysical and exploratory survey centered off the mouth of the Atchafalaya River below Morgan City, Louisiana. Commercial oil and gas leases were acquired in August, 1945, on 27 state-claimed tracts in the Eugene Island area aggregating 129,000 acres at an average cash bonus of $5.12 per acre. These tracts covered at least five separate prospects. Other large companies soon followed Magnolia's lead, and the present big gamble for offshore petroleum reserves began.

More than 25 companies are now interested in the quest for oil fields under the open sea in this area. More than $100,000,000 have been spent so far in geophysical and geological surveys, leasing, constructing special drilling barges and work boats, building huge platforms, installing land bases and radio communication facilities, and in drilling 70 or more wells from some 40 platforms. The present rate of expenditure on explorations in this tidelands area is estimated to exceed $70,000,000 per year. Although such a rate of expenditure may seem huge, it is small compared with the stakes, estimated by competent geologists as more than 5,000,000,000 bbl of crude oil.

No one knows how much oil may be discovered and produced ultimately from the tidelands off the States of Texas and Louisiana. Only a few have any idea how much has already been found in the 11 new fields discovered during the present campaign. Everyone watching the results knows, however, that discoveries are being made —and more rapidly now that about 30 operations are being carried on simultaneously. Three of the new oil fields were announced during the past two months. Many more should be discovered this year.

Three of the new fields appear to be gas or gas-condensate discoveries. Somewhere down dip, however, these reservoirs may yield rich accumulations of oil. Several of the new fields have rich oil sands at relatively shallow depths. Kerr-McGee's discovery well in Block 32 produces from about 1600 ft. Other new offshore oil fields resemble the thick sand multi-reservoir fields such as those on the coast at LaFitte and Paradis. Development of these fields may take years. A producing well off Louisiana usually holds a 5000 acre lease, so there may be little incentive to build additional $300,000 platforms until other leased tracts are tested. As many as 16 wells may be drilled from some platforms, but few coastal oil fields could be developed fully from one such platform.

The ratio of discoveries to wildcats should continue to be higher than on the carefully explored coastal lands bordering the Gulf of Mexico, and, as development continues and the oil is produced and barged or piped to land based terminals, the true magnitude of this petroleum reserve under the sea will be easier to estimate.

K Marshall Fagin

THE SUPERIOR OIL COMPANY'S LIMONEIRA NO. 1, IN VENTURA COUNTY, CALIFORNIA, BOTTOMED ON MARCH 13, 1949, AT 18,734 FEET FOR AN OUTSTANDING WORLD'S RECORD.

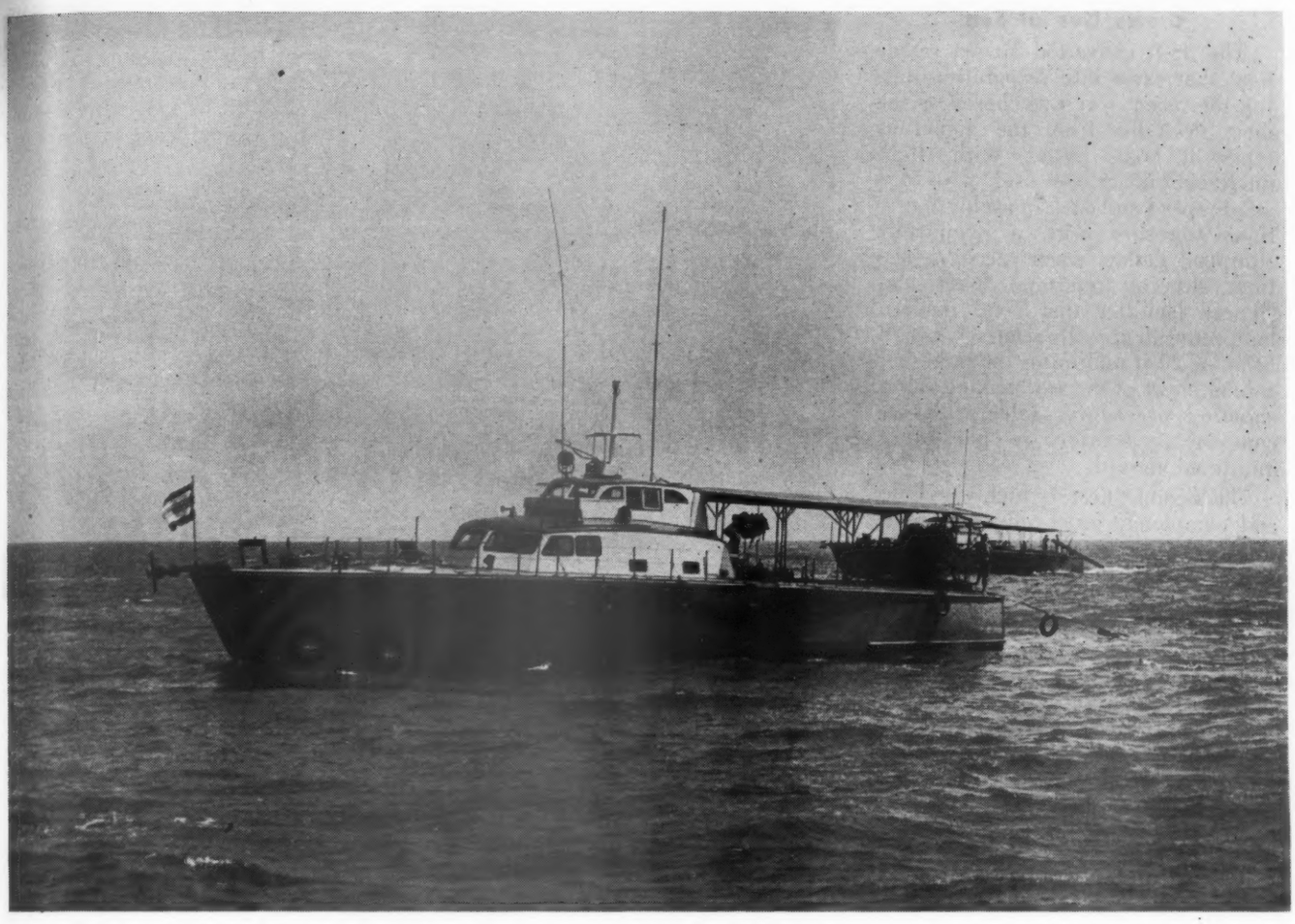
Again it is our privilege to participate in one of The Superior Oil Company's record breaking accomplishments — a privilege enjoyed ever since the inception of Baker Oil Tools, Inc.

The deep wells drilled by Superior always have been both a stimulant and a challenge to us. A "stimulant" to our efforts to furnish the correct Baker Equipment at the specified time — a "challenge" to be prepared with advanced Baker Oil Tools to handle the 20,000-foot wells soon to come.

Thank you, Superior, for the compliment of relying on Baker when "the chips were down" in the deepest hole ever drilled.

A Salute to SUPERIOR

and ENABLES BAKER PRODUCTS



Recording boat "*Tommie Nelson*" under way to next location. Shooting boat "*Eugenia J*" in background.

Offshore Seismic Exploration in Gulf

VIRGIL W. TEUFEL*

THE time worn phrase "Oil is where you find it" has again loomed across the horizon of a new geophysical frontier with the advent of seismic exploration for petroleum reserves in the Gulf of Mexico. Following the development of prolific oil bearing structures along the coastal plain that skirts the Gulf shores, geologists and geophysicists alike cast a longing eye across the Gulf waters under which lies the potentially great continental shelf.

In the past, worthy but incomplete attempts by many at offshore exploration were curtailed short of their goal when the demand for petroleum did not justify the continued expense of research for effective exploratory and drilling techniques. Such an outlook quickly changed, however, following World War II when rapidly diminishing reserves provided a stimulus for development. The results of only a few years work are phenomenal, having already established appreciable petroleum production with a method that is many times faster and one that gives coverage costs comparable to economical seismic land operations.

To the casual observer, the thrilling sight of deep water exploration with its clocklike precision may give a misleading conception as to its ease of attainment. To the geophysicist, however, the efficiency of present day operations is remindful of the development of specialized equipment, personnel, and procedures uncommon to those used on the plains of Texas, in the piney woods of Mississippi, or in the marshes of Louisiana; to the field technician, it represents unlimited time aboard boats in the restless Gulf, testing and using numerous designs of submarine cables, seismometers, radar, buoys, and boats while coping with the unfriendly elements — fog, hurricane winds, seasickness.

*District Supervisor, Geophysical Service, Inc., Dallas, Texas.

Note: Photographs supplied through the courtesy of The California Company. Taken by Manuel C. DeLerno, New Orleans, Louisiana.

EXCLUSIVE

Crews Live at Sea

The 85-ft converted air-sea rescue boat that came into recognition during the recent war was chosen as the most desirable from the numerous types of boats tested. With slight modification, this vessel provides ample speed and deck space for operations together with a completely equipped galley, electrical refrigeration, sleeping quarters, toilet and shower facilities that rival modern land conveniences. Its relatively broad beam of 20 ft minimizes the incessant rolling effect of the sea, making rapid shooting procedures safer with accompanying comfort to personnel quartered aboard.

The seismic fleet is highly mobile and completely independent of land ties except for the scheduled visits to any port for fuel and supplies. It ranges along hundreds of miles of coastline reaching locations as far as 60 miles offshore. It is designed to operate in moderately rough seas as well as to weather the fury of normal Gulf squalls and storms that strike with little warning. All vessels ride at anchor on the seismic prospect at night. Through ship-to-shore radio communications, however, the vessels may be ordered momentarily to another area in the Gulf that has taken exploration priority.

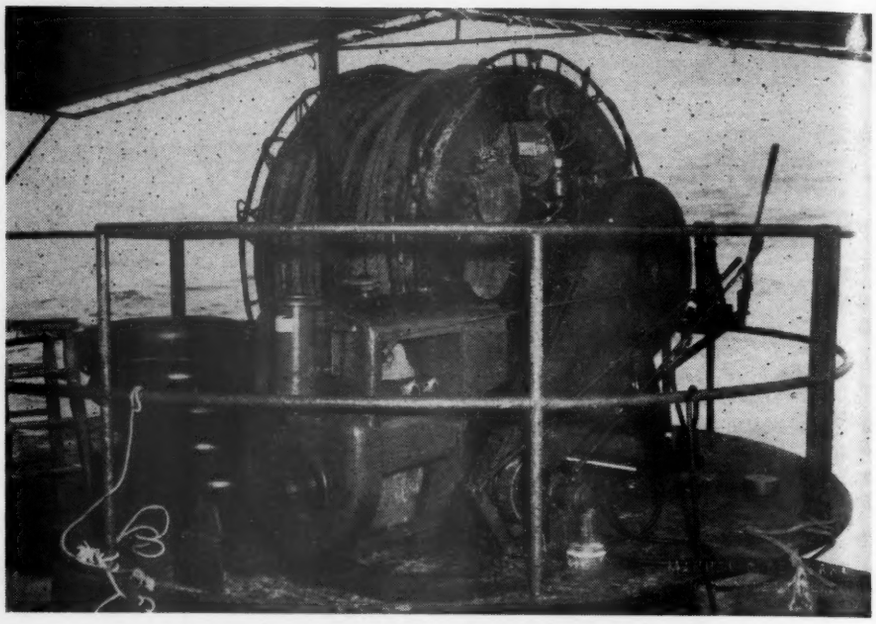
Six Boat Parties

Loss of time chargeable to boat failures has practically been eliminated through the use of six boats. Three are used in the Shoran surveying, two in actual shooting procedures, and one in the problem of liaison—all are interchangeable. A store of supplies is taken abroad prior to each 10-day period at sea. Daily rendezvous are scheduled by the supply boat chiefly to pick up the amassed seismograph records. In remote areas where travel time to and from the fleet is great, an amphibious plane is used to supplement this arrangement.

Electronic Navigation

Prior to the advent of electronic navigation, surveying by visual methods presented a formidable and time consuming problem as fog or haze often obscured the offshore target, although excellent shooting conditions prevailed otherwise. Noble efforts to extend visibility and range were tried —the most unique being the use of a 16- by 35-ft army barrage balloon.

In calm weather this soared majestically several hundred ft above the survey boat, but, when the wind arose, it turned into a "menacing demon," slashed back and forth, jerked at its moorings and usually destroyed itself against some of the equipment. Almost simultaneously with the introduction of shoran, sweep radar was tested and proved for a maximum useful range of about six miles.



Pivoted power reel that handles submarine cable.

Surveying Methods

The surveying principles of shoran and those of the visual method are similar. A given point is located by triangulation from two known points commonly referred to as base stations. The antennae were originally placed atop conveniently located oil derricks or lighthouses when exploration ventured only into nearby areas adjacent to land. Expanded geophysical programs and swift reconnaissance progress, however, made this semistationary arrangement obsolete.

Today, the offshore shoran unit quickly places seismic lines by utilizing boat-occupied base stations that may proceed at will to two of several pre-determined base positions. As now used, locations up to 22 miles distant may be made in fair or foul weather with an accuracy approximating 100 ft.

Explosive is primed only seconds before going overboard.

Seismic Procedures

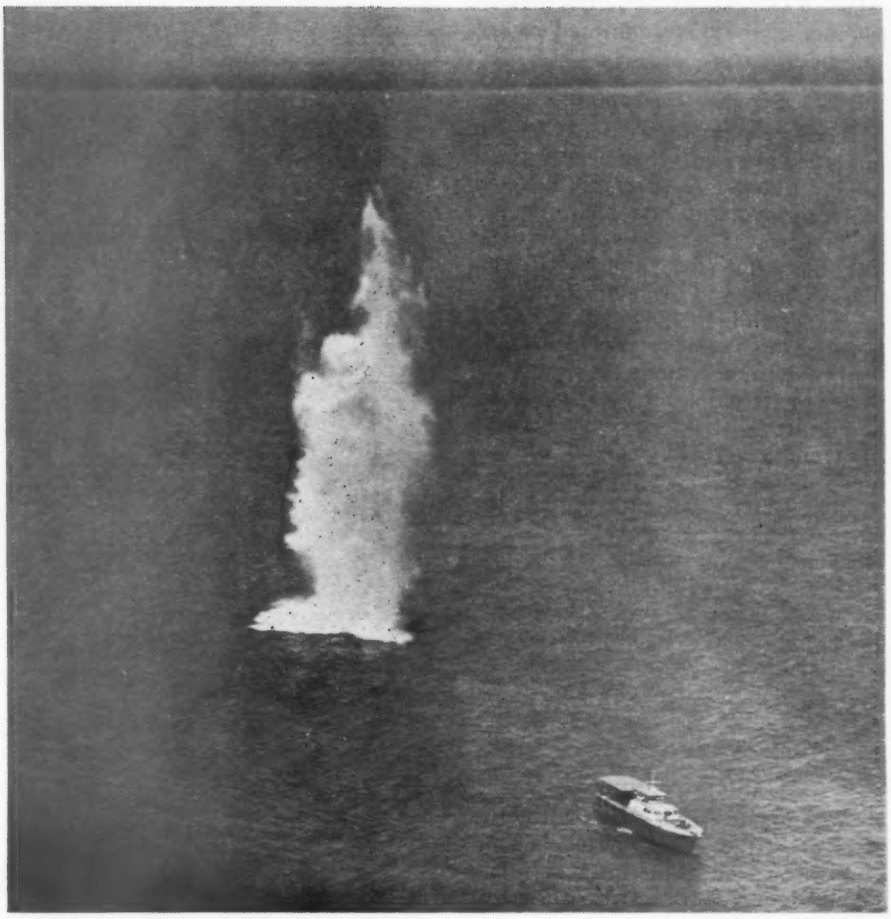
The actual recording-shooting procedures that begin with program planning and end with the final shot fired each day are highly coordinated with split-second timing. Besides efficiently utilizing the time, this is necessary as recording operations are conducted without anchoring and must be accomplished within the periodic, momentary pause in which the shot is made before adverse tides and winds can foul the submarine cable and place the recording boat in a hopeless and helpless condition. This apparently effortless synchronization is accomplished by a brief radio-telephone contact between the shooting boat that has a primed charge in the water and the recording boat that has arrived and paused at a new location.

Colorful large balloon buoys designed especially for prolonged life under wave buffeting serve as shot point markers to guide both recording and shooting operations. They are laid out at constant intervals by the shoran boat, which has a snakelike

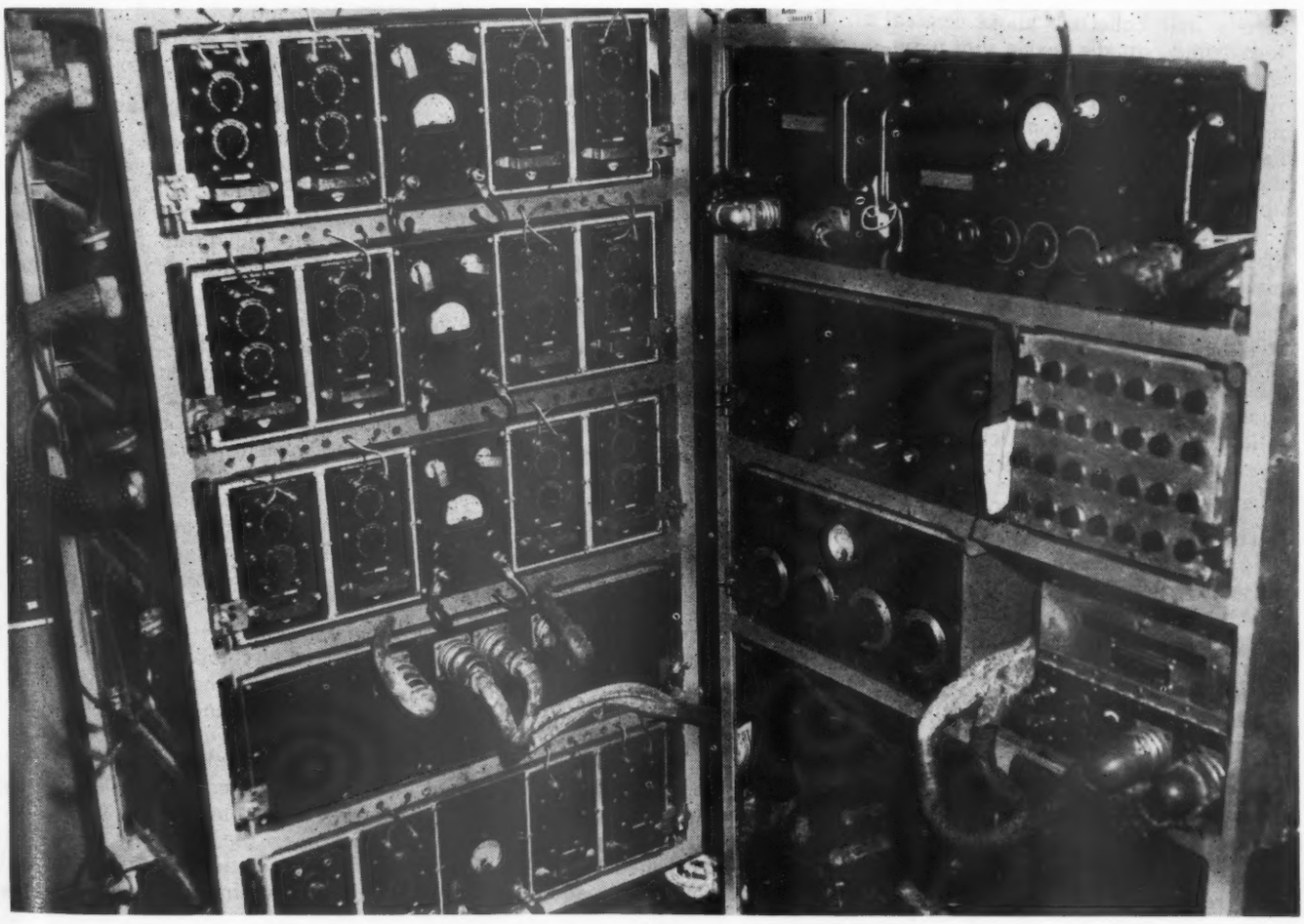
manner of arriving at the intersection of pre-determined range coordinates. Sufficient markers placed in advance assure continued operations even though either one of the three shoran transmitters may temporarily go off the air.

Fog Is No Obstacle

The rather marvelous fact that seismic recordings can be taken as often as every two minutes in sunshine or fog, miles from the sight of land, has been only partially explained by the foregoing. Specialized equipment such as the multiconductor, steel-reinforced submarine cable that has been dragged across hundreds of miles of sea bottom warrants explanation. In addition to the severe abrasive action of sand and shells as well as an occasional tussle with sunken ships, it is pulled through thick offshore deposits that occasionally offer



"Move in . . . in the water . . . Ready? . . . SHOOT!" Gull's-eye view of a charge being fired.



Seismic instruments are mounted with rubber shock cord to reduce the pounding effect of the sea.

enough resistance to stop the forward motion of the diesel-powered recording boat.

Seismic Equipment

The regular-spaced detectors are designed to withstand the rugged treatment to which they are subjected. A large pivoted power reel, mounted on the boat's stern, lowers the cable into the water and withdraws it from the sea bottom in a matter of minutes.

In addition to the dual recording system that records twelve straight and twelve composite traces, a special water-break amplifier aids in recording desired distances in times between shot and instrument spread while a water noise filter removes the undesirable water-transmitted high frequency energy.

Safety is the watchword at sea. Swimming is prohibited as strong running tides have a velocity greater than that of a swimmer. Preservers are worn while working in rough seas and special precautions are taken against fire as well as in preparing and firing explosives.

Lightning Hazards

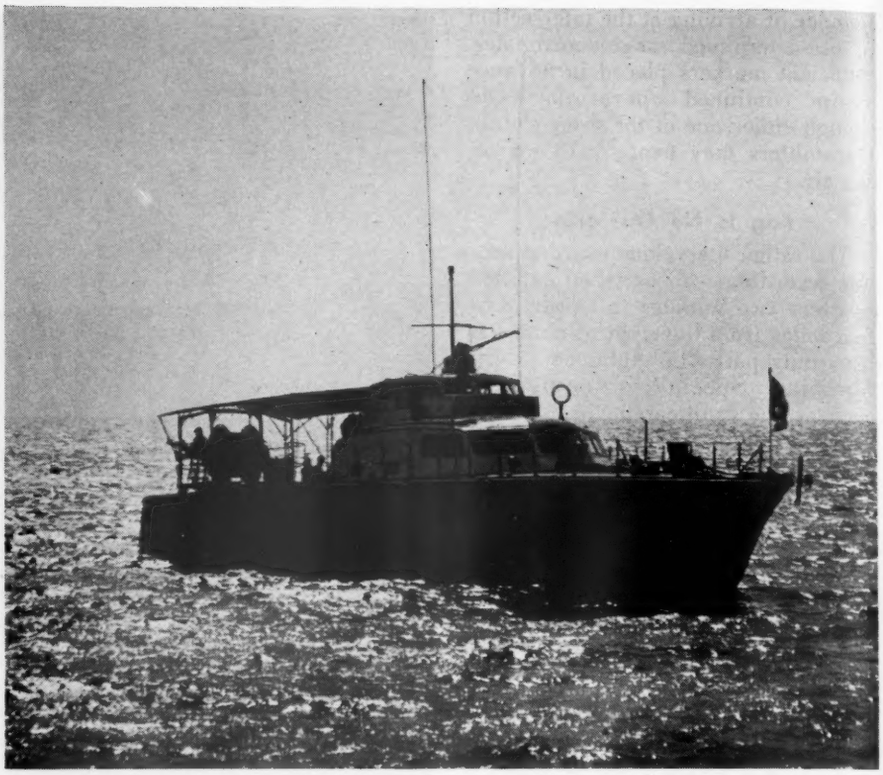
Additional experiences with the hazards of the sea occur in phenomenal ways, such as the instance when, unwittingly, lightning was caused to strike in a given place. On a typical hot midsummer day, large cumulus clouds had collected above several well-defined squalls near a shot point. As the column of water from the shot reached its peak of about 300 ft, lightning reached down from the sky and flashed up and down the column into the sea with a deafening clap of thunder.

Operations were suspended for a 25-min period during which no lightning was observed; however, when the work was resumed, the previous display was duplicated. Needless to say, procedures were suspended for the day. Several weeks later the phenomenon recurred under similar conditions and mildly shocking the shooter.

Weather Reports Heeded

The movements of hurricanes are followed offshore by listening to regularly scheduled radio weather reports. As a further precaution, storm courses are plotted in the office on shore that maintains radio contact with the fleet. Should the latter fail, a plane is dispatched to advise of the approaching storm.

Many factors such as weather, program planning, and the type of exploratory work, i.e., reconnaissance or detail, govern the production obtained. This is better understood when it is realized that a reconnaissance usually consists of a gridded network of long lines along which exploration may continue for hours without interruption. Conversely, when detailed information is desired in a given locale, considerable time is consumed in traveling from one short line to another. Comparatively speaking, the expense per month is high; however, the high rate of production reduces the cost per profile to a figure comparable to or less than many land-based seismic units.



On location.

Operations Mapped

The field office is the hub from which all activities stem and the point where all loose ends are woven carefully into one concise plan. Here Shoran range readings are taken from the large base boards or maps of the coastline, supplies are ordered, men are briefed for the forthcoming period of work offshore. An alternate plan is generally formulated, one which will most advantageously match the conditions at sea.

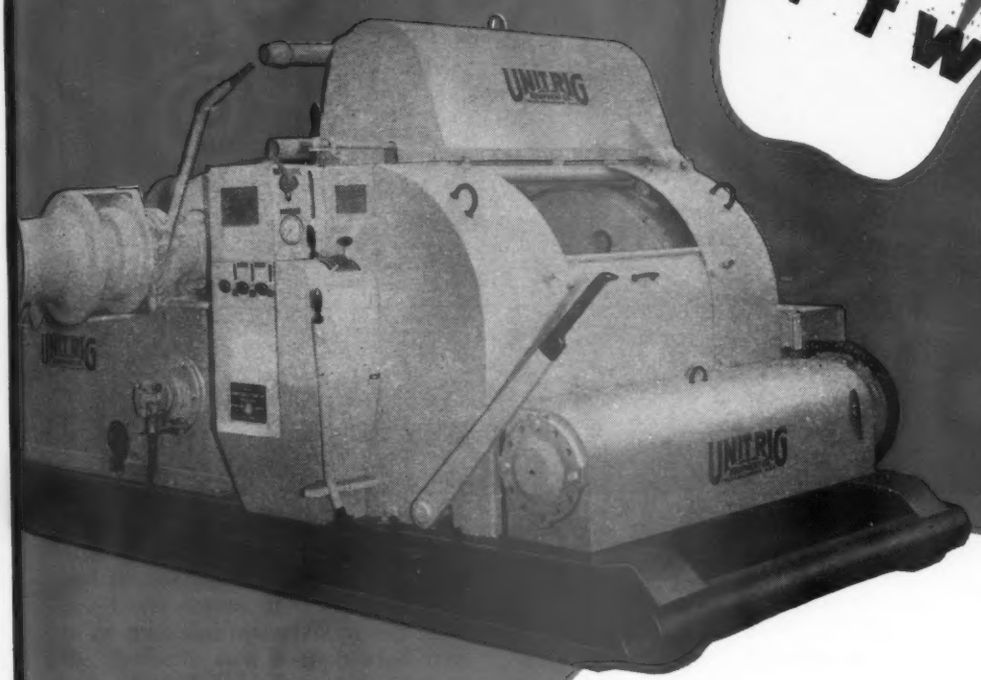
The interpretational phase of the work is completely segregated from the executive and administrative duties, so that specialization in each category can be accomplished. While the analysis of 300 to 700 profiles per week may appear to be a geophysicist's nightmare, it is actually handled in a thorough and orderly manner. This is accomplished by four trained computers aided by an equal number of assistant computers who interpret the records, plot, and study the cross sections. Subsurface maps are constructed and areas of interest reviewed by the seismologist in conjunction with a draftsman.

High Quality Records

The quality of data is generally much better than that obtained upon the adjacent land. This is not difficult to understand when it is realized that the weathered layer diminishes in thickness seaward, and that constant tidal action might be expected to deposit uniformly or remove any existing weathered material. The latter has been borne out in the study of reflections that reveal little weathering differences. Exceptions to the statements given above, of course, occur near the shore or in an area where thick alluvial deposits obviously exist.

Much remains to be told of the ever-changing details and of experiences rivaling those in fiction that space will not permit to be recorded. An article on the subject discussed would not be complete, however, without a tribute to the men who, with inexhaustible patience, give unstintingly of their time to make such an undertaking successful; to the men who spar with the elements while handling sensitive instruments and tons of explosives; to the men who have vitalized interpretation; to the pioneers of the petroleum industry! ***

FOR THE MAN WITH ONLY TWO HANDS...



U-15

Two hands are all it takes to operate Unit Rig's Model U-15. See how the controls are placed close together. See how few controls are needed. Simplified controls on the U-15 reduce fatigue of the operator, lessen the possibility of error, and save time during drilling operations. If your drillers are normal, two-handed men . . . they'll appreciate Unit Rig's ease of control.

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Pure Oil Company's drilling barge-platform about 8½ miles off coast of Vermilion Parish, Louisiana, with auxiliary boat.

P 422.91

Offshore Drilling Problems in the Gulf

K. MARSHALL FAGIN*

DEVELOPMENT of oil and gas fields in the offshore waters of the Gulf of Mexico is proceeding more rapidly every day. New submergible drilling barges for drilling in relatively shallow water and converted LST's and YF's for use in conjunction with drilling platforms have been outfitted in the shipbuilding yards along the Gulf Coast and put to work on about 30 of the 200 or more prospects that have been outlined by geological and geophysical exploration.

Most of the drilling and exploration activity is being carried on inside the 27-marine-mile limit off the coast of South Louisiana, from Vermilion Parish on the west to St. Bernard Parish on the east. The water covering this continental shelf is as shallow as 20 ft at some places 30 miles from land, and most of the area is covered with less than 40 ft of water.

Aside from the fact that the water off the Louisiana coast is shallower than that off the coast of Texas, the short length (5 years) of the Louisiana leases and the high annual rentals for delay in development (one-half of the initial bonus) make it economically advantageous for the companies to test their holdings as soon as possible. Drilling activity on a tract saves a company from paying the delay rental on it, and most of the tracts cover about 5000 acres.

More than 2,600,000 acres have been leased in the Louisiana tidelands since 1945. Initial bonuses averaged about $10 per acre, or a total of about $26,000,000. The leased area amounts to about 60 per cent of the 4,400,000 acres offered for leasing by the State of Louisiana. Some of the earlier leasing was of the checkerboarding variety and cost little more than an option to explore. A few of these exploratory leases have been dropped after geophysical work failed to indicate favorable structural conditions. Others are being held for further exploration or drilling. The number of favorable prospects left to drill is a matter of interpretation and opinion. Estimates range from 100 to 200, with time and further experience favoring the latter figure.

Only one sale of offshore leases has been held by the State of Texas. More than 300 separate tracts aggregating 367,845 acres were leased in November, 1947, for a little more than $7,000,000, or about $19.30 per acre.

*Editor, Exploration, Drilling, and Production.

EXCLUSIVE

These leases are for primary terms of 10 years with annual delay rentals of only $1 per acre. It is evident, therefore, that a company owning leases in both Gulf areas would have somewhat less incentive to drill its Texas leases than its Louisiana leases.

The operators' greatest problem in converting these submerged leases into a series of prolific oil fields is predicting the weather and the condition of the sea. The depth of the water itself is not much of a hindrance to the erection of drilling platforms. Wells in Lake Maracaibo have been drilled in deeper water as a matter of routine for many years. The water in the open Gulf is so much rougher most of the time, however, that it is difficult to keep the work and supply barges tied up and anchored securely to the well platforms.

Hurricanes and other severe storms that blow in from the West Indies make the tidelands of the Gulf Coast a hazardous place to explore, build platforms, and drill for oil. None of this work can proceed in the face of a 100-mph wind and 15 to 30-ft waves. Much of the work has to be shutdown and abandoned in much lighter winds and lower waves. It is often difficult to get men and materials to and from the platforms in a 40-mph wind with waves 5 to 10 ft high.

Some of the companies employ weathermen of their own and issue regular weather forecasts and warnings. Others depend on the U. S. Weather Bureau forecasts that are broadcast regularly by radio for the benefit of fishermen and ships at sea. In either case, warnings of approaching storms often mean that work under way must be prepared for abandonment by the crew within a few hours. Much time is lost during such storms, although, so far, the loss of rigs, platforms, and vessels has been relatively light.

Transportation of men, equipment, fresh water, and drilling materials from the shore bases to the drilling platforms is another one of the problems of offshore development. Aside from the effect of the weather on such operations, the time involved in such transfers is usually considerably more than the time required for similiar transfers on land. The work barges have to be loaded at the shore base, the vessels are propelled slowly, the platforms are sometimes as much as 50 miles from the bases, and the materials and equipment are usually unloaded by small cranes or winches.

Although transportation is usually slow, high frequency radio and marine telephone circuits provide instant communication between rigs, shore, crew boats, and work barges. Radar and Shoran networks are also utilized extensively for navigation and offshore surveying probelms, particularly in exploration work. These facilities increase the efficiency of many offshore operations considerably, and tend to offset some of the disadvantages discussed above.

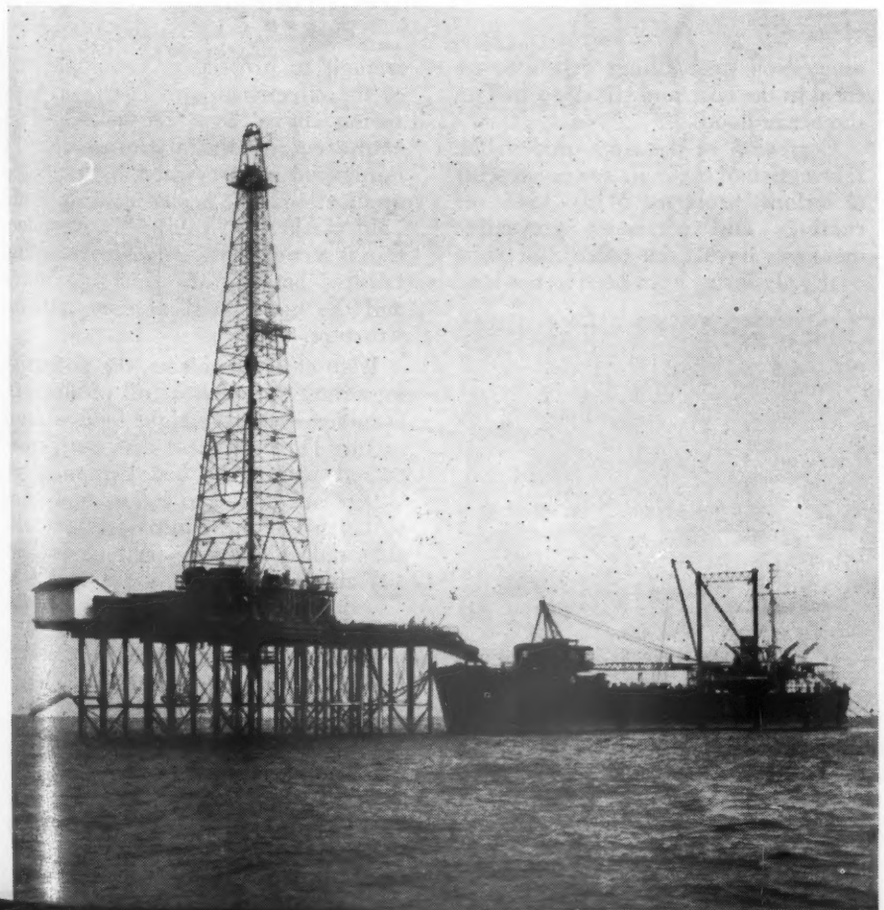
Drilling Operations

A few of the offshore drilling platforms are large enough to accommodate all drilling equipment, mud pits, auxiliary machinery, and living quarters for the crew.* Most of the drilling platforms, however, depend upon auxiliary LST or YF barges to house the crews, to carry the mud pits and slush pumps, and accommodate the other machinery, equipment, and extra material necessary to drill and complete the offshore wells.

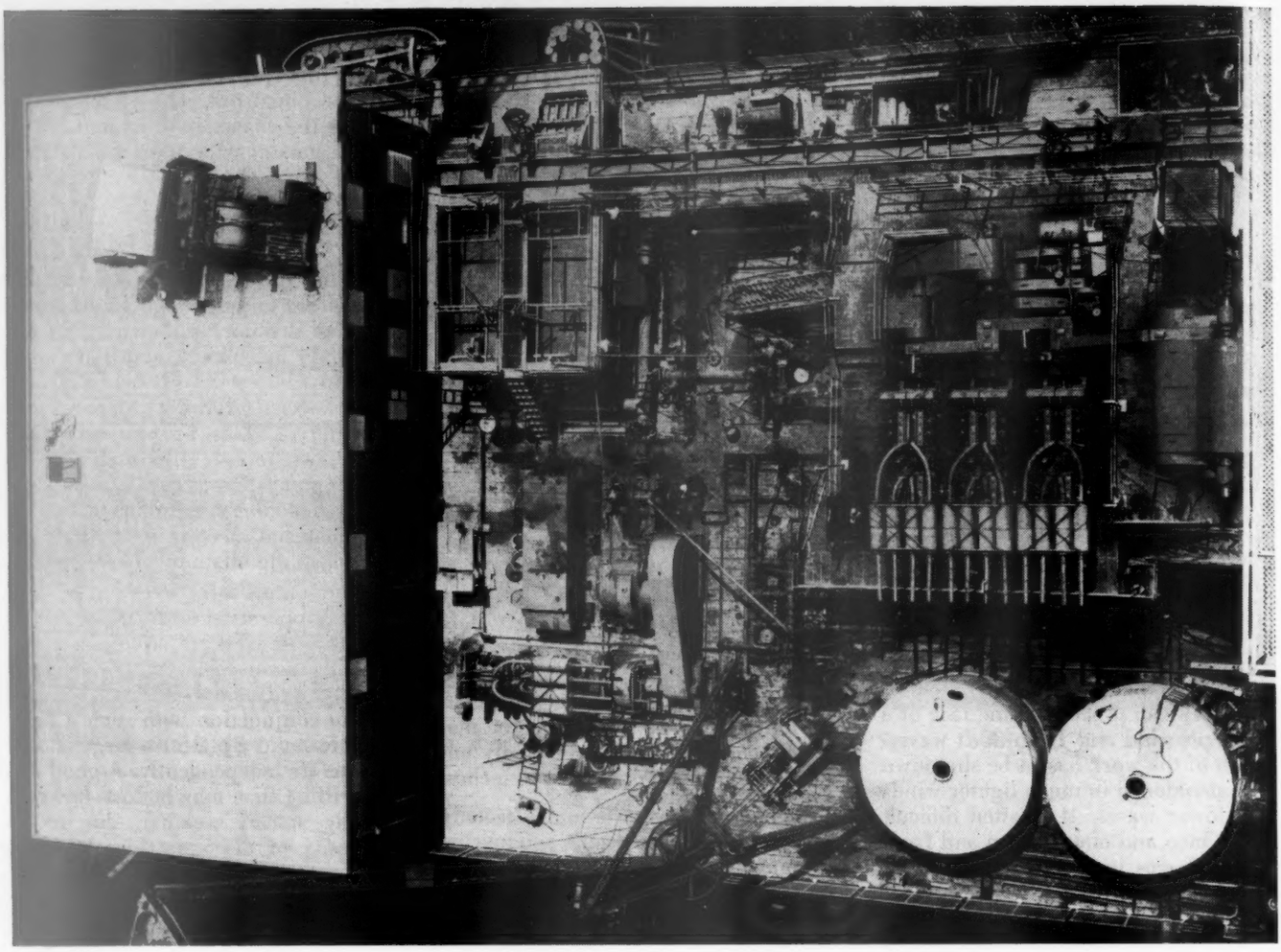
The small platform-barge type drilling operation adds greatly to the mobility of offshore equipment. It is usually much easier and less expensive to build a small platform for drilling in conjunction with such a barge than to build a platform large enough to operate independently. A good deal of drilling time may be lost, however, during stormy weather, due to the necessity of disconnecting the barge

*See "Humble's Offshore Drilling Program," by K. Marshall Fagin, in *The Petroleum Engineer*, June, 1948, page 56.

A small platform-drilling barge combination in use by Humble Oil and Refining Company in the Grande Isle area off Jefferson Parish, Louisiana.



Don Ford operates the 45-ton crane that is anchored in the frame of Pure's "R. W. McIlvain" drilling barge. Here, in his glass house, he has lifted all sorts of equipment.



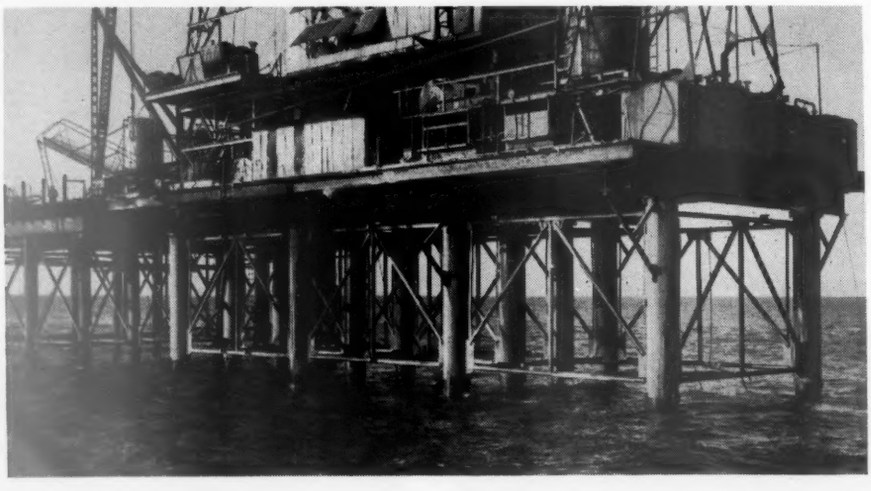
Stanolind's large drilling platform from the derrick shows the rear of the drawworks (right center), 3 main diesel drilling engines, two reserve mud tanks (lower right), a whirley crane, slush pumps, and mud pits (upper left). Roof of crew house and dry storage building is at left of photo.

from the platform. And, where several wells may be drilled from one large platform, it might be more desirable in the end than the more mobile platform-barge combination.

The accompanying photographs show some of the drilling platforms and platform-barge combinations that have been used in offshore work thus far. Many types of barges and platforms have been designed for offshore drilling. Some are submersible and others have special telescoping columns, but most of the structures used so far in offshore operations are erected on steel pilings driven to refusal in the ooze and silt deposited on the ocean flood.

Corrosion of the steel used in the fabrication of these platforms presents a serious problem. Many kinds of coatings and corrosion preventive measures have been taken, but none of the platforms have been in use long enough to provide an adequate test of the effectiveness of coatings. Corrosion above the water level and of equipment on the platforms can be minimized or prevented by repeated applications of various coatings and paints. Abrasion caused by wave action is a contributing cause of coating failures between the low tide mark and the upper part of the platform structure.

With all its problems, the potential importance of offshore oil production is indicated by the eight fields found so far. Three of these discoveries occurred within the last two months. Others are bound to follow now that so much floating equipment is available and so many operations (about 30) are underway. * * *



Fourteen large piles support the drilling rig section of Pure's offshore drilling platform. Twelve smaller piles support the drill pipe rack section of the platform.

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For complete information on Black Magic, White Magic, Chemical X and OB Zero, contact your nearest Oil Base, Inc. office or write

OIL BASE, INC.

130 ORIS STREET, COMPTON, CALIFORNIA

BRANCH OFFICES: Houston, Oklahoma City, Midland, Walters, Casper, Bakersfield, Long Beach, Ventura.

EXPORT: Petro-Tech Service Co., Caracas, Maracaibo, VENEZULA; Elmer R. Smith, Caracas; G. Saavedra E. Hijos, S. de R.L., MEXICO, D.F.

Extra-heavy mud is wanted when there is danger of excessive gas pressure. It is also used to hold back salt water under pressure, to keep the well "static," and to restrain the flow of oil while drilling. "Feather-weight" mud is necessary to combat lost circulation. With the addition of Chemical X or OB Zero to Black Magic, this drilling fluid can be maintained heavier or lighter than any other known mud.

Use Chemical X in combination with "Heavy" Black Magic to obtain very high weighted mud. Chemical X keeps Black Magic in a fluid state by lowering the viscosity and enables more weight material to be added than is normally possible. With Chemical X, Black Magic can be weighted as high as 21#/gal. (157#/cu. ft.).

Use OB Zero to increase the viscosity of "Light" Black Magic or Black Magic Premix and then add diesel oil to dilute the mud until the weight and viscosity are suitable. By this means a drilling fluid with desirable properties and yet a weight of only 7.5#/gal. or 56#/cu ft. (approaching specific gravity of diesel oil) can be easily made.

Magnetic Device Measures Stress on Pipe in Wells

PHILIP W. MARTIN

ONE of the most common problems in oil well drilling operations and salvage and abandonment jobs is stuck drill pipe, casing, or tubing. The problem, of course, is—just *WHERE* is the pipe stuck?.

Every oil operator has used, at one time or another, various systems—graphs, mathematical tables, and "cut and try" fishing methods, to locate the "stuck" point. Under ideal conditions—in straight and shallow holes, these methods sometimes work satisfactorily. Ideal conditions, however, are unheard of in these days of deep wells, where extreme temperatures and pressures are the rule not the exception.

Certain engineers,* knowing the limited ability of these methods and realizing the need of solving the problem as quickly as possible, due to the critical shortage of casing and drill pipe, set out to alleviate the situation in a practical way.

The problem was first analyzed, and it was found that the conditions when attempting to locate the stuck point in casing, drill pipe, or tubing were these:

When stress is applied to the pipe from the surface it causes stretch, compression, or torque in the section of the pipe that is free. Obviously, there is little or no stress below the stuck point. The problem, then, is to find the point where pipe stress stops, which, of course, is the stuck point.

After many months of experimentation, a new kind of oil well tool was developed. It is an electronic tool known as the Magna-Tector, and has been employed to date on more than 2000 jobs in numerous fields. Many of these jobs were accomplished under adverse conditions yet, in every case, the tool has aided in the recovery of drill pipe or casing, savings in operating time, and a substantial reduction in "re-drill" footage required after a fishing job.

The tool is a scientific instrument that measures the deformation of the pipe in a localized area in the well when a stress is applied to the pipe at some point remote from the localized area. It contains two electric magnets of special design in conjunction with a telescopic joint that is combined with a sensitive electronic device. The tool is run into the well until the area selected for testing is reached. Then, electric current is turned into the conductor cable, energizing the two magnets and causing them to cling to the wall of the pipe, thus fixing the tool in relation to the pipe.

Strain or stress is then applied to the pipe, causing stretch, compression, or torque in the section that is free. Any stress naturally moves the two magnets in relation to each other. This movement of the magnets, which may be as little as 0.001 in., is detected by the sensitive electronic element and transmitted to the meter at the surface. If the pipe is stuck, or rigidly held against stress at the elevation at which the test is being made, there will be no pipe stress to actuate the electronic element, and therefore no reading on the meter. When this condition is found, the instrument is set at progressively higher points until pipe stress is indicated. Once this point is reached, a few more settings should indicate the stuck point, rapidly and positively.

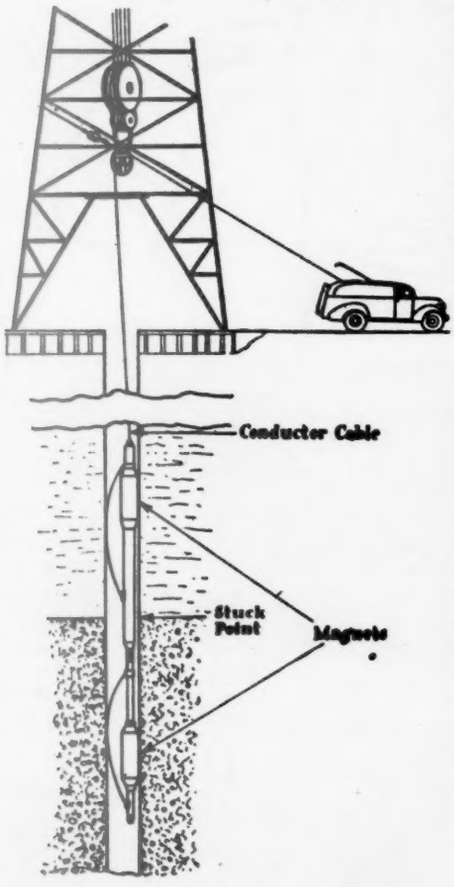
Resetting the tool for testing at different levels requires only the shutting off of the current, moving to a new level, and re-energizing the magnets. As many settings as desired may be made without coming out of the hole.

Sensitiveness of the tool is almost beyond belief! It is capable of measuring a movement of about one-third the thickness of a human hair three miles down in an oil well. Usually, such sensitiveness is not necessary on an actual job, but it aids greatly in localizing the stuck point.

The instrument has many uses, such as:

1. To determine whether the tubing is stuck above or below a packer.

Diagram showing how the electromagnets cling to the casing or drill pipe during a series of tests to locate the stuck point.



EXCLUSIVE

The Author

Philip W. Martin is director of research in charge of electrical development for McCullough Tool Company, Western Division. He is a native of North Dakota, spent some 9 years in Canada, and began his career as an oil man doing research work on geophysical methods for a major company.

He first joined McCullough Tool Company late in 1939, and has since been responsible for the development of many instruments and devices of importance to the petroleum industry. Among his inventions are a sonic indicator, an ultrasensitive weight indicator, a tachometer, a fire control circuit, a surface recording pressure indicator, and the Magna-Tector.

THERE'S NOTHING AS FINE as the LUFKIN LINE

LUFKIN 35-9 with gas engin drive and sub-base. Tide Wate Associated Oil Company, Yello Creek, Mississippi.

LUFKIN pioneered and developed the application of reduction gears to oil well pumping. The first unit was placed in operation in a gulf coast field in 1923. In the more than a quarter century of specialization in the manufacture of walking beam type pumping units, Lufkin has attained the enviable position of number one producer of such equipment.

Applied skill, plus constant improvement in design and application of Lufkin units, has contributed to the maintenance of that position.

It shall be always the Lufkin objective to produce the very best unit in the field. Yes sir! There is nothing as fine as the Lufkin Line!

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INDUSTRIAL SPEED REDUCERS AND INCREASERS

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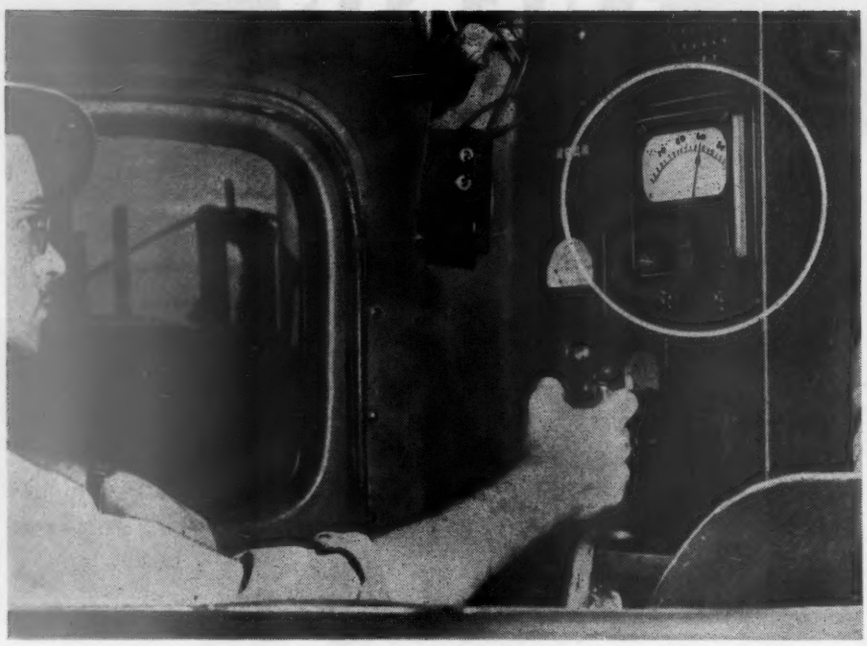


Operator in service unit controls running, setting, and measuring work of the electromagnetic tool. Right: Final adjustments are made on a 3½-in. tool before it is run into the hole. Indicating meter on the rotary receives signals from the magnets in the tool.

2. To indicate how much casing can be recovered in one length with one inside cut.

3. To measure the change in stress in a string of casing.

4. To find out whether a string of casing is actually in tension when it is landed.

5. To locate the effective top of the cement around casing.

6. To locate the tool joints in a string of internal upset drill pipe.

The tool was designed primarily to eliminate costly cut and try fishing methods that so often cause complications and damage to the well. Frequent use of this tool by oil operators has resulted in several important benefits, such as:

1. Saving rig time by locating the stuck point quickly.

2. Saving pipe footage by allowing cutting, shooting, or backing off at the deepest possible point.

3. Making subsequent fishing operations easy and simple.

4. Saving time and tools and minimizing chances for accidents, delays, or damage.

5. Indicating the proper level for spotting oil to free the pipe.

6. Eliminating estimates and calculations based on pipe stretch.

7. Determining in many cases, the cause of sticking.

8. Minimizing redrill footage.

Other Methods. The early Greek philosophers confined their activities largely to speculations about Nature, and to attempts to reconcile the observed behavior of bodies with theological doctrines. What has been called the scientific method began to appear in the time of Galileo (1564-1642). Galileo's studies of the laws of freely falling bodies were made not in an attempt to explain why bodies fell toward the earth, but rather to determine how far they fell in a given time, and how fast they moved. Physics as it exists today has been called the science of measurement, and the importance of quantitative knowledge and reasoning has been expressed by Lord Kelvin, famous Scottish physicist (1824-1907), as follows:

"I often say that when you can measure what you are speaking about, and express it in numbers, you know something about it; but when you cannot express it in numbers, your knowledge is of a meagre and unsatisfactory kind; it may be the beginning of knowledge, but you have scarcely, in your thoughts, advanced to the stage of science, whatever the matter may be."

Until the introduction of this new magnetic tool probably the most satisfactory method was the one known by experienced cable tool men as the "vibration" method. In practice, a drive down spear was run into the well and actuated by the walking beam or jerk line on a cable tool rig.

The spear was first lowered to the bottom of the well, then tripped, a wire line jar having been run on top of the spear. When the jar was actuated by the jerk line and the pipe was freed, vibration was assumed to be transmitted up the free pipe to the surface. Then, when the spear was positioned below the stuck point and the jar again actuated, no vibration would reach the surface. This method left much to be desired as wells were drilled deeper.

The "stretch" method was more effective in some cases than the drive down spear method. The use of stretch tables and graphs, together with a surveyor's level to measure the amount of movement with a certain number of tons pull at the surface of the well, sometimes indicated the "free" point. In deep and crooked holes where slack accumulated around the bends, however, and in cases where the sticking medium was of a fractional nature, this method was often found to be in error by as much as 6000 to 7000 ft.

The surface electronic equipment of the Magna-Tector can be operated from a readily available power source, such as a six-volt automobile battery. The Magna-Tector itself is so small it can operate inside of the smallest drill pipe, and so light it can easily be transported by automobile or plane. ★★

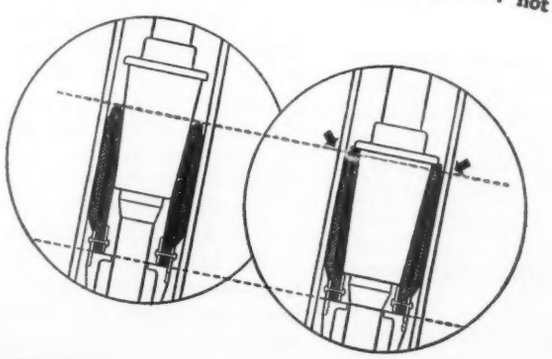
AMERICAN IRON HEAD PACKER!

FOR DEEP HOLES . . . HIGH PRESSURES!

The new Type GM American Iron Control Head Packer has ALL the field-tested features of our popular Type G Control Head Packer PLUS such additional design features as Dovetail Slips. This new packer can also be furnished with friction block assembly instead of friction springs, if desired. In every way, this packer is engineered for extra heavy-duty performance requirements encountered in areas where extremely difficult conditions exist. It is now being manufactured in our plant with the expert "know how" that comes from our 26 years of Oil Field Equipment manufacturing experience. Here, again, is evidence of American Iron's leadership—a leadership maintained by constantly producing products that meet the ever-increasing needs of the oil industry.

SEALS WITHOUT CRUSHING THE CUP!

Because the American Iron super cup assembly is expanded laterally . . . not compressed . . . it seals without crushing the cup. The two pictures below tell the story. In the left circle you see the tapered mandrel descending into the packing element, expanding horizontally against the casing as the mandrel moves downward. In the circle at right, the mandrel has stopped in its final position. Note how, through the force of lateral expansion, the rubber has moved up (see arrows) and now forms a positive seal. The packing element is now expanded laterally . . . not compressed!



LARGER MORE EFFICIENT SEALING AREA!

A complete seal is accomplished with one cup assembly (sealing element) which results in a large, perfectly sealed area that will withstand highest pressures encountered. This, plus the expansion and contraction feature which allows the packer to be set and reset many times without changing cup assemblies, results in the most versatile and economical packer available.

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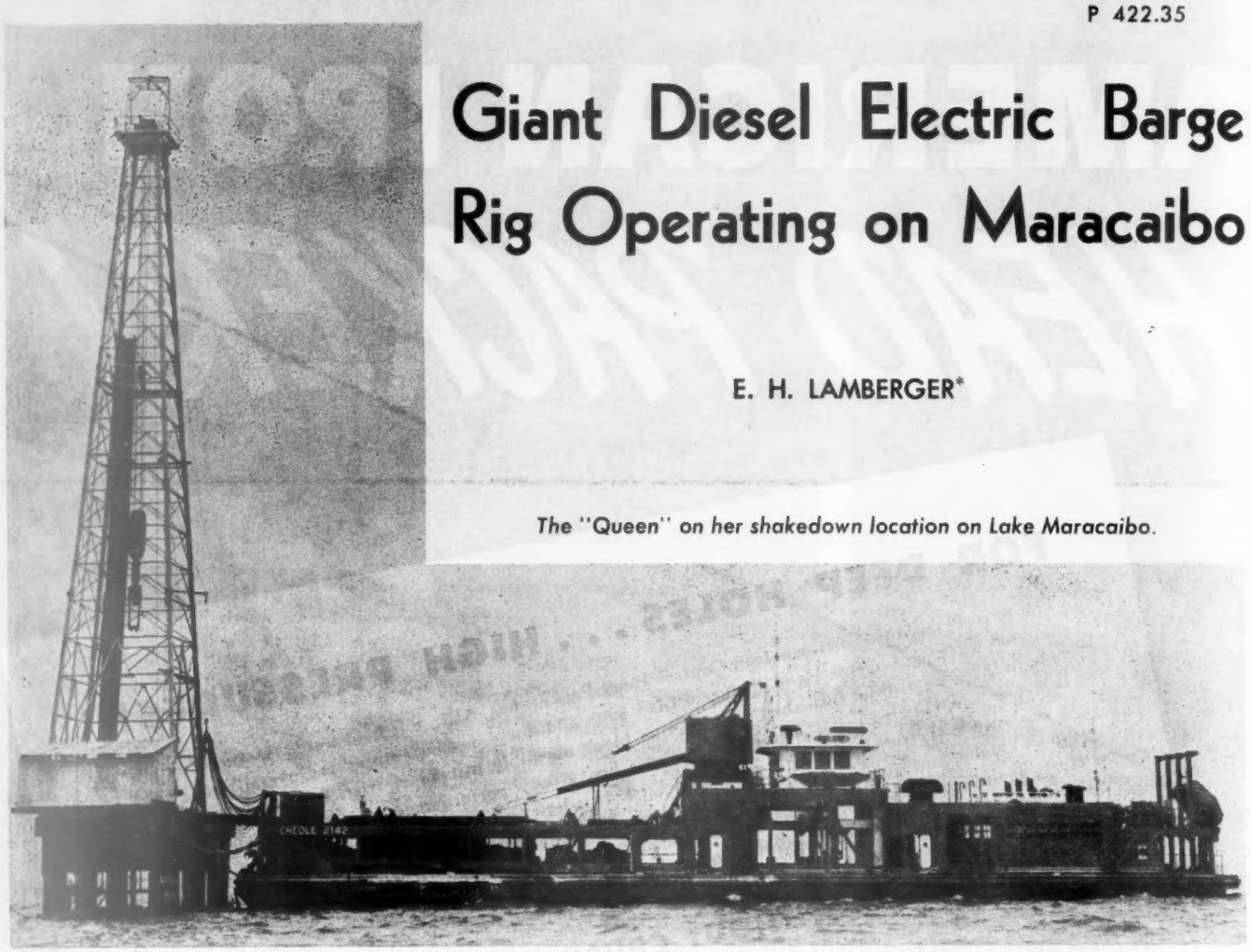
P 422.35

Giant Diesel Electric Barge Rig Operating on Maracaibo

E. H. LAMBERGER*



The "Queen" on her shakedown location on Lake Maracaibo.

THE most powerful diesel-electric drilling rig ever built—total generating capacity of 1500 kw—is now in operation on Lake Maracaibo, Venezuela. Designed and built by the Creole Petroleum Corporation for exploratory drilling to depths of 15,000 ft, the rig represents a forward step in operating simplicity, reliability, and safety.

Present drilling operations are in water depths up to 110 ft, but greater depths are in prospect. Derricks are supported on caissons of reinforced concrete cast around welded steel cylinders several feet in diam. Prefabricated steel structures assembled atop the caissons support the derrick floor well above a possible 20-ft wave height.

The decision to use a diesel-electric, d-c, adjustable varying-voltage type power system was reached following a careful study of its operating characteristics and the job to be done. The basic reasons for selecting the diesel-electric, d-c, rig are:

1. It is relatively self-sufficient on any location, requiring only engine fuel, water, and lubricants to maintain a constant power supply.

2. A maximum amount of apparatus can be permanently mounted on a barge, minimizing foundation investment and erection and dismantling costs when changing to a new location. Yet, it provides for uninterrupted operation during many storms.

3. Drilling operations can be continued throughout most storms as power is supplied through flexible electrical cables. It is possible to move the barge away from the caissons without interrupting operations as corresponding flexibility of mud lines is provided. Should a storm become severe, the drill string can be raised in the hole, several stands set aside, if necessary, and, with the drill string hung on slips, the electric power cables can be disconnected quickly and the barge moved to a safe location.

4. Fast operation is provided for through: (1) the inherent smoothness of the power-application characteristics of the d-c adjustable varying-voltage system; (2) the flexibility provided through being able to use any main generator on any drilling operation and being able to use the power of all three main generators on the drawworks motor for hoisting; and, (3) the convenience to the driller of being able to control all drilling operations from his station on the derrick floor.

5. The operating characteristics afforded, the relatively high overall efficiency provided, and the reliable engine performance due to the protection provided by the generator load-limiting characteristics, all combine to provide fast, economical drilling operations, which means more time on bottom.

Electrical system

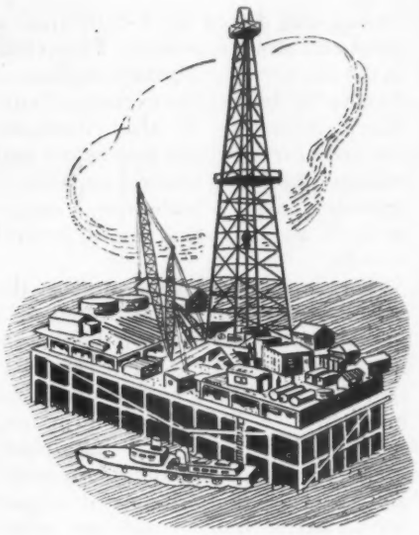
Simplicity of control consistent with oil well drilling requirements—provides a maximum degree of continuity of operation. This simplicity is achieved through the use of a minimum number of machines, machine types, and of control equipment. Crews become familiar quickly, therefore, with the operation and maintenance of the equipment. This not only reduces possibilities of troubles but also tends toward more rapid repairs.

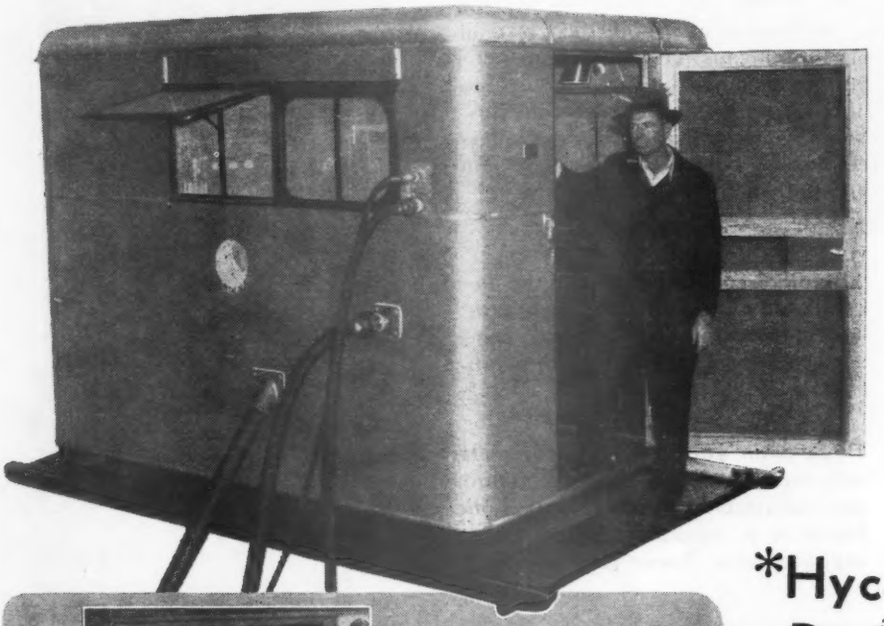
The main generators are operated at full speed continuously. Exciters and auxiliary generators are mounted

*Industry Engineer, Westinghouse Electric Corporation, Pittsburgh, Pennsylvania.

HP

* Logging Service now available for Off-shore Operations



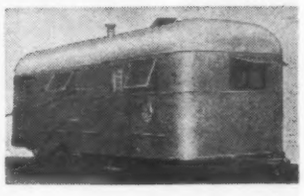


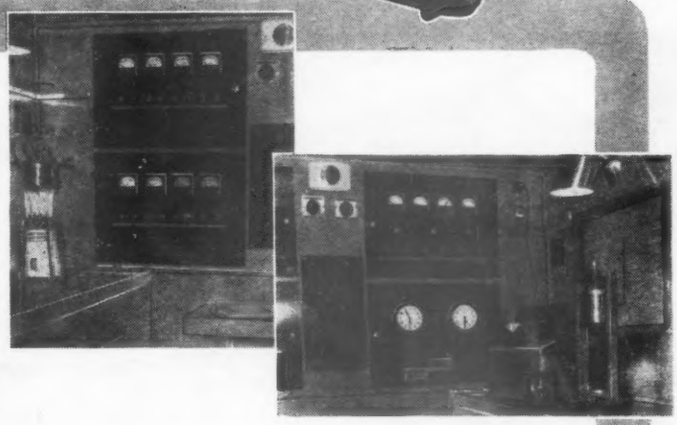
Accurate Log Data assured by compact marine unit

*Hycalog's Hydrocarbon Profile Logging System

Here is a new unit designed especially for Marine operations where information is all important and floor space is at a premium. The instruments are housed in a 6½' x 10' "skid mounted" laboratory and are exact duplicates of all analytical equipment in a conventional HYCALOG HP* Well Logging Unit.

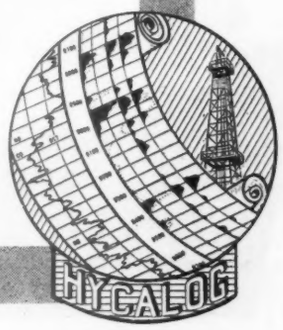
These new units are being made available in limited numbers in addition to our fleet of trailer units. For further information on the economies and advantages of regular or marine HP logging—Write, wire or phone today.





INSTRUMENTS & EQUIPMENT

- **Instruments for Oil and Gas Detection and Evaluation in well "cuttings."**
- **Equipment for pumping Flow Line returns into the Unit.**
- **Instruments for indicating depth and correcting sample lag.**
- **Instruments for Drilling Mud control.**
- **Intercommunication set with Driller.**
- **Facilities for obtaining and preserving depth corrected Geological samples.**



The Hycalog Company

517 FIRST NATIONAL BANK BUILDING
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on top and driven by V-belts from a front-end shaft extension. This eliminates the need for separate engines or motors for driving the exciters or auxiliary generators. It also eliminates the need for auxiliary generators and voltage regulating control capable of operating over a wide speed range, as well as an engine speed control system.

The generator design protects the diesel engine from being overloaded and permits operation of the engine at full-speed continuously. This contributes to reliable engine operation and effective hoisting performance, because the engine is at full speed, ready to deliver full output immediately at each hoist. Repeated engine accelerations under load are eliminated.

All auxiliary power is supplied directly at 125 volts, as d-c power must be provided for generator and motor field excitation. It is preferable for some auxiliary loads due to better overall speed-torque characteristics of d-c motors, and it is desirable for the blowers of the main motors as the interlocking of the control of the blower motors with that of the main motors is accomplished more easily. The provision of alternating current power in addition to d-c power would require a-c motors to drive the d-c auxiliary generators, as it is not practical to mount three machines—a-c generator, d-c generator and adjustable voltage exciter—atop the main generator. By using only d-c power for auxiliary service the number of machines and amount of control is kept to a minimum. Furthermore, the wiring is a simple two-wire system rather than a complicated combination of two-wire service for direct current and three-wire service for alternating current.

All blower motors of the five main motors and auxiliary mud pump motor are interchangeable. Other machines that are interchangeable are: the three main generators, the three exciters, the three main mud pump motors, and the four auxiliary generators.

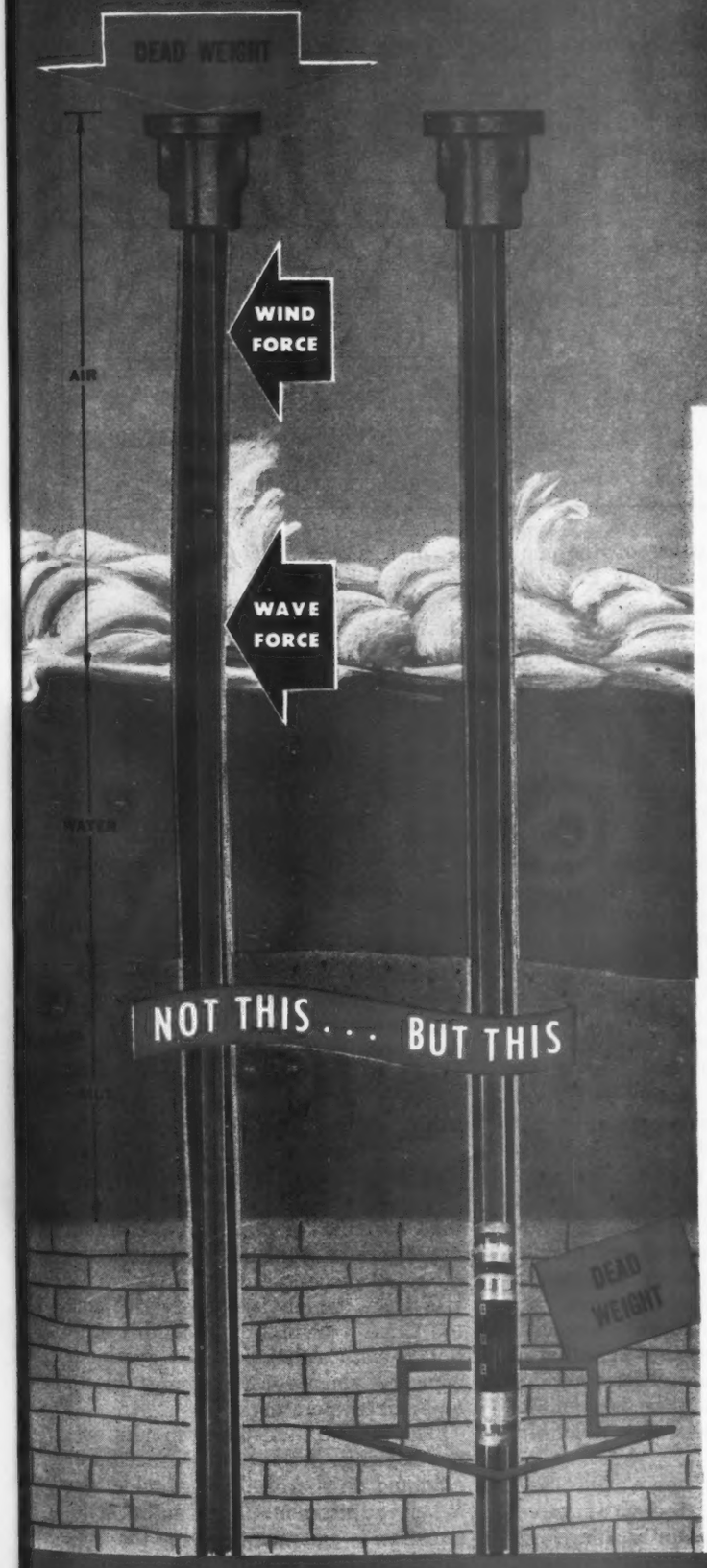
Detail of control structure in the engine room shown below. The operator's section of "dead-front" construction is in the right foreground.

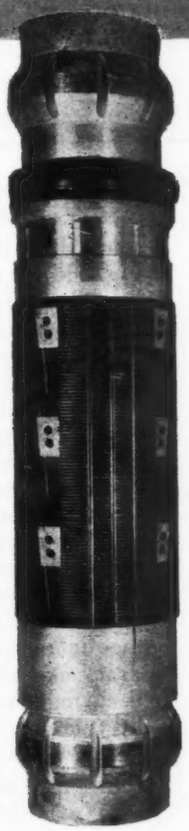
Three main engine-generator units, with top mounted auxiliary generator and adjustable voltage exciter. The fourth is a separately driven auxiliary generator (lower left-hand unit).

Announcing the new

O-C-T

TYPE DH-1
CASING HANGER
FOR
SUBSURFACE INSTALLATIONS





O-C-T Engineers, in cooperation with development engineers of a major oil company, have succeeded in designing this revolutionary means of putting casing weight down the hole . . . the oil industry's first off-shore casing hanger.

On off-shore and other water locations, the outer casing string is often ***unsupported*** for many feet with conventional hanger equipment . . . yet this long, slender, unsupported column is called on to support long, heavy, inner strings.

It is an accepted engineering fact that columns of high slenderness ratio ($\frac{l}{r}$) buckle readily under load. A conventional casing head used at the surface of the water puts all the weight of the inner strings on the outer string, which load added to natural forces from waves, wind and corrosion creates a dangerous condition.

The new O-C-T DH-1 Casing Hanger puts the weight on the outer string at a point where solid formation supports it, eliminating the column load and also eliminating the chances of dropping the inner strings in case of accidents to surface equipment.

The O-C-T "Down-the-Hole" Casing Hanger is simple to set. Simply install it in the inner string at the point to be suspended, run it in and cement. After cement has set, adjust tension on inner string, pump between the strings and setting is automatic. ***No rotation is required at any time.***

Write today for complete prices, delivery and setting details on this revolutionary new O-C-T Casing Hanger that eliminates a common hazard in off-shore operations. Available in usual casing size combinations.

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Oil Center Tool *Company*

P. O. BOX 3091 HOUSTON, TEXAS

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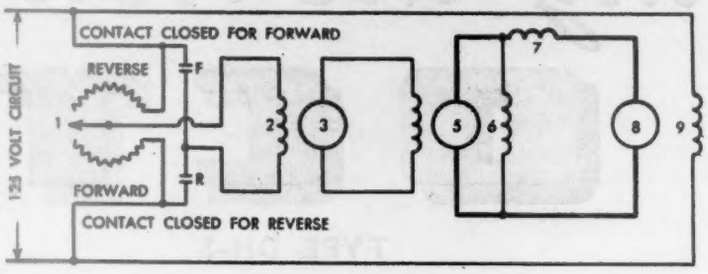
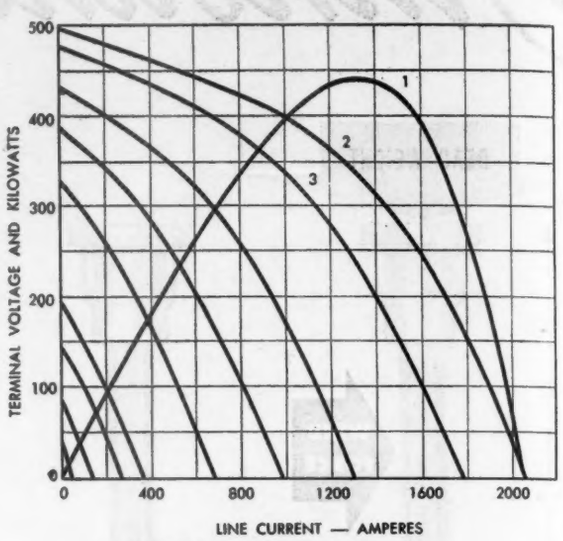
FIG. 1.



1. DRILLER'S MASTER CONTROLLER.
2. SEPARATELY EXCITED SHUNT FIELD OF ADJUSTABLE VOLTAGE EXCITER.
3. ADJUSTABLE VOLTAGE EXCITER.
4. SEPARATELY EXCITED SHUNT FIELD OF MAIN GENERATOR.
5. MAIN GENERATOR.
6. SELF EXCITED SHUNT FIELD OF MAIN GENERATOR.
7. DIFFERENTIAL SERIES FIELD.
8. MAIN MOTOR.
9. CONSTANT SEPARATELY EXCITED SHUNT FIELD OF MAIN MOTOR.

FIG. 2.



1. KILOWATTS—FULL EXCITATION.
2. VOLTS—FULL EXCITATION.
3. VOLTS—REDUCED EXCITATION.

Electrical equipment

The electrical equipment has been grouped into two classifications to simplify description: The adjustable varying-voltage, main power drilling equipment (Table I); and, the constant voltage auxiliary power equipment.

The main generators are of the three-field type: a self-excited shunt-field connected across the main generator armature; a separately-excited shunt-field connected across the adjustable-voltage exciter; and, a series-differential field that carries main generator armature current and opposes the two shunt-fields.

This three-field design provides for a definite limit to the no-load voltage, to the load on the engine, and to the maximum current output. Such inherent characteristics mean protection for the engines, motors and drilling equipment. The scheme of generator excitation, as well as the basic control circuit, is shown in Fig. 1. Volt-ampere characteristics of the main generator are shown in Fig. 2.

When the driller's master controller in Fig. 1 is moved from the "off" position to obtain forward motor rotation contact F closes and current from the 125-volt d-c supply flows through the field of the adjustable-voltage exciter and the resistor of the master controller. As the controller is advanced, more resistance is cut out, and the armature current and the voltage of the exciter continue to increase. The adjustable-voltage exciter supplies current to the separately-excited field of the main generator in proportion to its voltage. The main generator voltage increases with the increase in separate excitation. The self-excited field current and excitation automatically increase with main generator voltage.

Thus, for each master-controller "point," of which there are more than fifty, there is a definite generator shunt-field excitation. As load is applied the series-differential field of the main generator reduces the net excitation in a manner to cause a droop in the generator voltage. The voltage droops to "zero" whenever the excitation equals the excitation of the two shunt fields. Therefore, for each controller point there is a definite maximum current as well as a definite no load voltage.

The main motor has a shunt-field constantly excited at a fixed value. The speed of the motor is, therefore, proportional to the generator voltage, and the motor torque proportional to the current flowing through the armature.

This arrangement means that the driller has complete control of the speed and torque of the motor. As he advances the master controller the torque increases by small increments until enough is available to "support" the loads. Further advance increases the motor speed.

Such characteristics provide smooth, fast pick-up of any load, smooth application of torque to any stalled load, limit in torque and speed of the various drives—all accomplished at the will of the driller and without abuse to the engines.

The generators and exciters are self-ventilated in contrast to the forced ventilation of the motors. All generators are provided with solid covers on top openings and screen covers on bottom openings. This makes the machines drip-proof, yet offers protection against rodents and mechanical injury. Corrosion-resisting brushholders are used on all generators and motors. Both motors and generators are built with ring lubricated sleeve bearings, suitable for marine and drilling rig service. Motors and generators are all rated on a continuous duty 60°C rise basis, which is conservative for the Class-B insulation used throughout, a feature that provides overload capacity and protects against high-ambient temperatures.

The 500-hp mud pump motors are two-bearing bracket type machines mounted on slide rails to provide for V-belt adjustment. The motor construction is adequate to carry the belt drive overhung on the rear bearing. The motors are of splashproof and rodent-proof construction and can be washed down with a hose.

The 800-hp drawworks motor is a

TABLE I

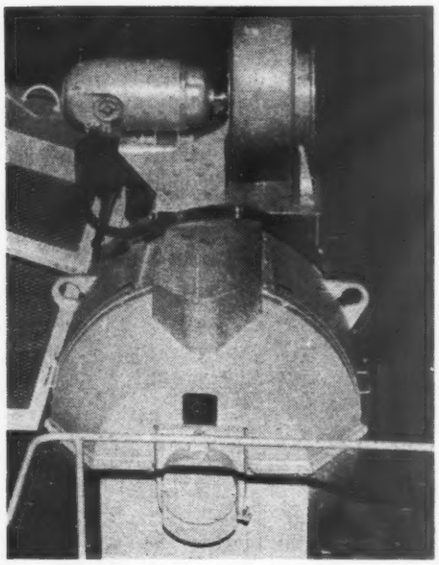
Adjustable varying-voltage main power drilling equipment.

3—400 kw, 395 v, 360 rpm adjustable varying-voltage generators direct connected to diesel engines.
3—Adjustable voltage exciters for main generators.
3—500 hp, 395 v, 900 rpm mud pump motors.
1—800 hp, 395 v, 600 rpm drawworks motor.
1—300 hp, 395 v, 750 rpm rotary table motor.
1—Complete adjustable varying-voltage control which consists of:
1—Main control structure, on barge.
1—Terminal structure, on barge.
1—Set driller's master controllers with three handwheels.
1—Driller's pushbutton station.
1—Driller's foot switch.
1—Driller's meter cabinet.
3—Start-stop pushbuttons, one at each main mud pump.
1—Set of multi-conductor cables wired to receptacles and plugs.

two-pedestal bearing machine assembled on a rigid skid-type bedplate. The construction is designed to maintain bearing alignments when the equipment is moved to a new location. The chain drive to the drawworks is carried overhung on the rear bearing.

The rotary table motor is a two-bearing bracket type machine. Normally the motor is coupled to the rotary table, but its construction is such that an overhung chain drive to the drawworks may be used. This provides for getting off bottom any safe distance should the drawworks motor become inoperable. The motor construction is splash-proof and rodent-proof with watertight conduit box.

One of three 500-hp mud pump motors with top mounted blower units.



Motor ventilation

All main motors, and the 60-hp auxiliary mud pump motor, are ventilated by individual blower units mounted atop the motors. The 115-v d-c blower motors are of the explosion proof type as defined by the U. S. Bureau of Mines. With air intakes piped to a safe supply, it is possible to purge the main motors before starting them, and to continue operation in a hazardous atmosphere. The blower motor control and the main motor control are interlocked so the blower must be started before power is applied to the main motor. This blower arrangement also provides constant ventilation regardless of main motor speed.

Main control equipment

The control equipment is designed to provide the flexibility of power transfer necessary as illustrated by Fig. 6, and to give the driller complete and immediate control of all drilling operations from his position on the derrick floor. Safety of personnel is also provided.

The main control structure in the engine room is built in two sections: One of "dead-front" construction; the other an enclosed "live" section with electrically interlocked doors. On the dead-front section are mounted those items that the operator must observe occasionally and manipulate to determine electrical or engine performance, or to make various possible transfers or setups, or to take machines out of service. The dead-front construction and attendant control scheme makes it entirely safe for the operator to make any observations or manipulations required. The apparatus on this section includes: indicating ammeters and voltmeters for all main and auxiliary generators, which make it possible to check the loading of each generator and engine; various transfer switches for taking generators out of service or for connecting them to any one of the several main power circuits as emergency conditions may require for interchanging mud pumps, for making various special set-ups for drill-up operations, and for changing the power supply to the crane and anchor winch motors; disconnecting breakers for the auxiliary generators, receptacles and plugs for connecting any one of the auxiliary load circuits to any one of the auxiliary generators

FIG. 3. *Speed torque characteristics of 500-hp 900 rpm motor taking power from 1 generator of 400 kw.*

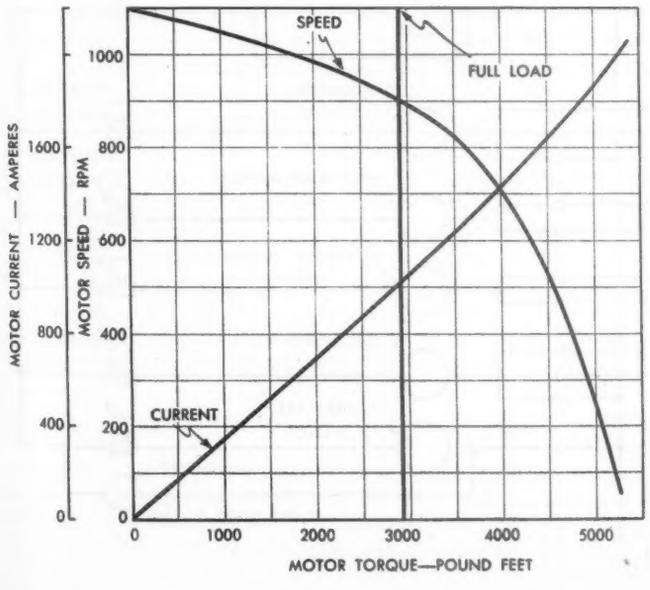
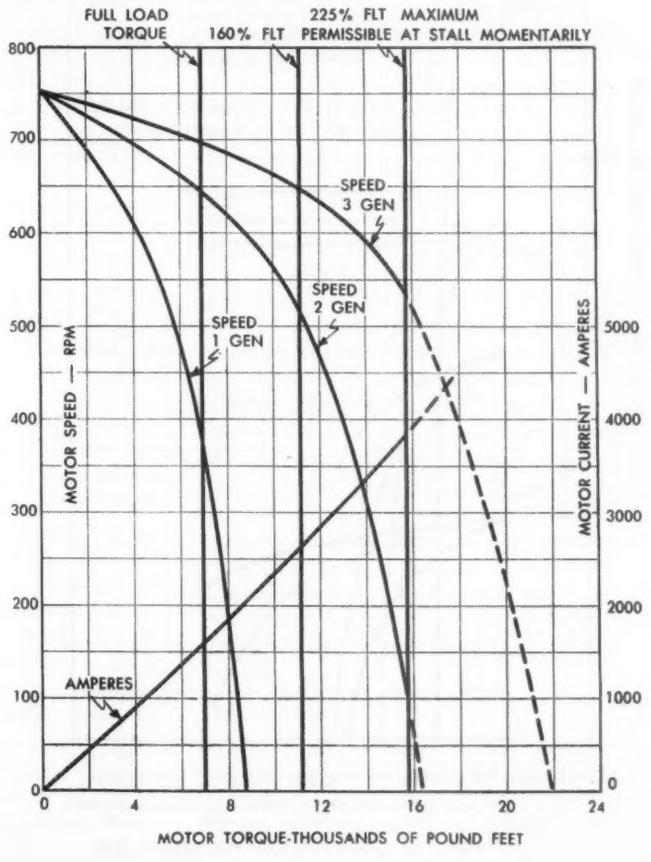


FIG. 4. *Speed torque characteristics of 800-hp 600 rpm motor taking power from 1, 2, or 3 generators of 400 kw.*



or all of the load circuits to any one of the four auxiliary generators; disconnecting breakers for some forty auxiliary power circuits; and recording ammeters and voltmeter for main motors.

Recording meters were provided to afford data on performance requirements and continuity of operation for the various drives. Four meters record the line current of the three main mud pump motors and the drawworks motor. From this current record, motor torque values may be determined quickly. Two recorders show the torque and speed in rpm of the rotary table motor. Data on loads, length of operating periods, and down periods is particularly valuable in exploratory work.

The live section of the structure houses contactors and relays. The front is completely enclosed with electrically interlocked doors. Access to the rear of both sections is through electrically interlocked doors, one at each end of the passageway. The opening of any door will immediately disconnect main and auxiliary voltage from practically all apparatus on the structure. Means are provided, however, for opening any or all doors to inspect and test without disconnecting power service. Lights are always available on the structure, regardless of door position or which auxiliary generator may be running.

Connections

All connections to the derrick floor are made by means of marine-type watertight receptacles and plugs, and single-conductor main-power and multi-conductor control cables. These are grouped at a single terminal structure, and all the cables have reinforced jackets of synthetic rubber. The plugs and receptacles are built so that incorrect connections cannot be made. All connections can be made or broken in a few moments. Connections are secured by a threaded collar. Screw-on caps provide protection for plugs and receptacles when circuits are disconnected. All plugs and receptacles are grounded electrically to protect personnel.

The "swinging" cables are looped over a support mounted on the derrick. The support is adjustable in height by means of a ratchet drum mounted at the edge of the derrick floor. By this means, the cable swing is adjusted to meet requirements for relocating the barge with relation to the derrick floor.

The cable aboard ship is of the same type as the swing cables, but has a bronze basket-weave armor.

Multi-conductor control and meter cables were wired at the factory and tested in conjunction with the main control equipment to simplify the initial wiring-up in the field. Connecting-up at a new location is a relatively simple matter.

Driller's control

The driller has complete control of the three main operations—bit rotation, mud pumping, and hoisting—from his station at the drawworks. This control is afforded him by means of the three master controller handwheels, the pushbutton station with emergency stop, drill-hoist, drill-up

FIG. 5.

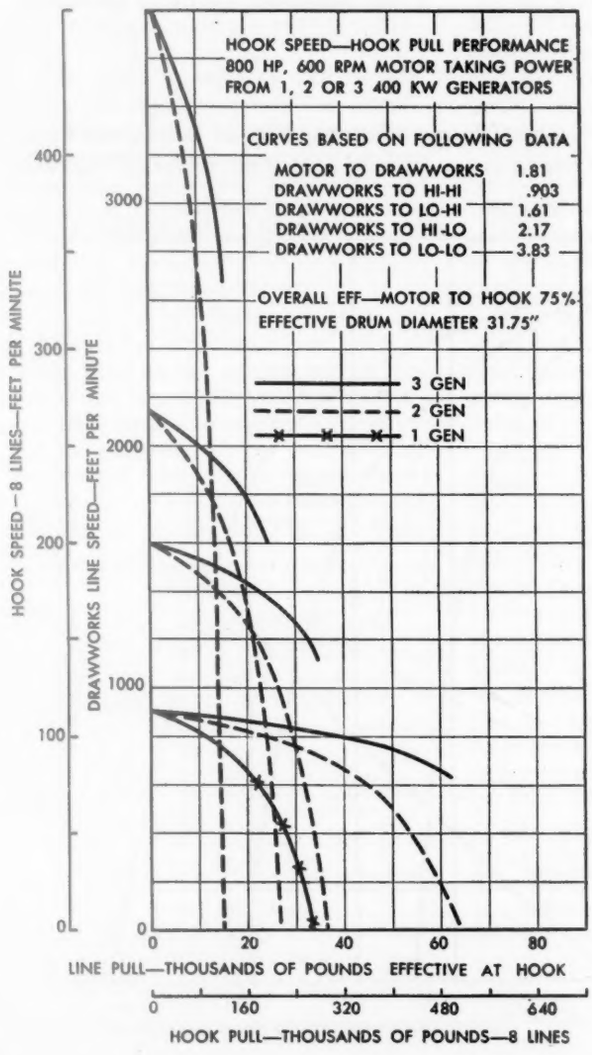
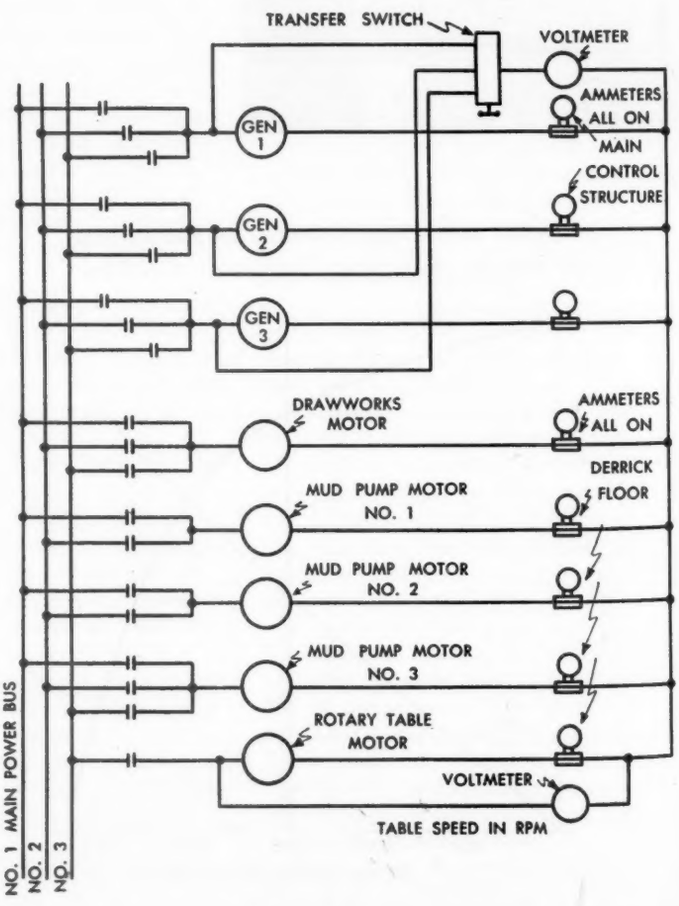
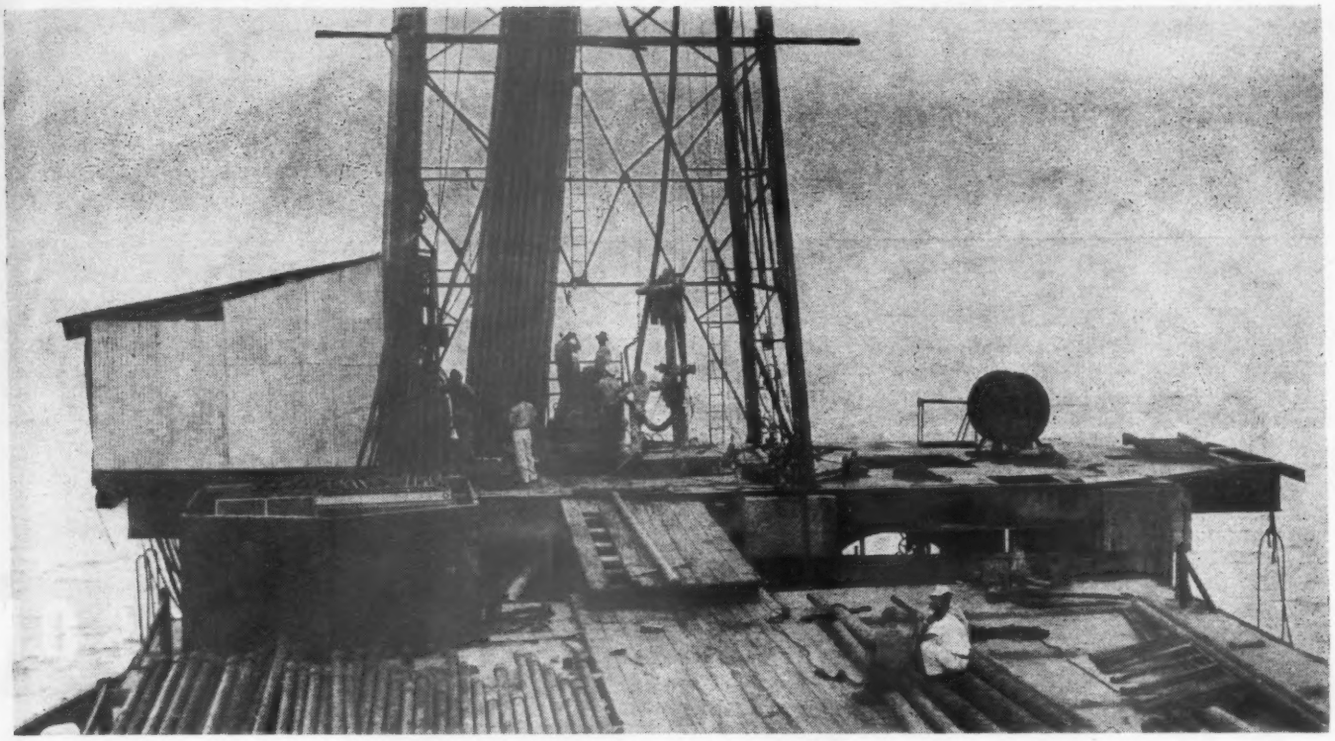
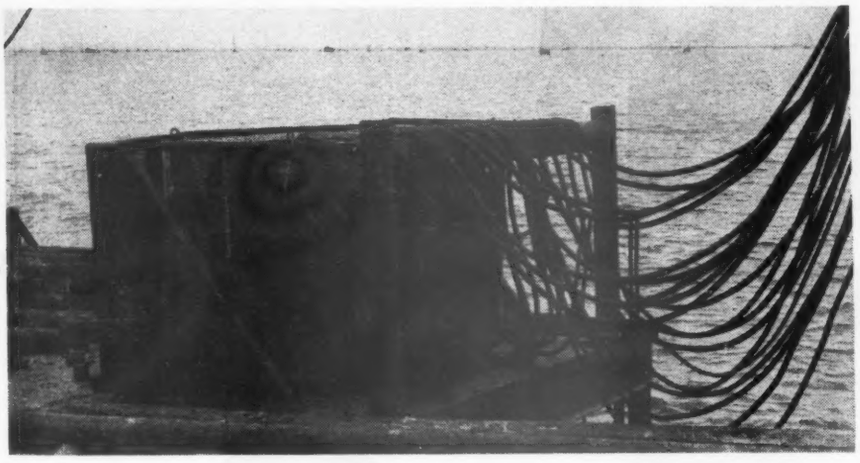


FIG. 6.





Pipe deck and derrick floor. Note terminal structure for electrical cables in left foreground.



Close up of terminal structure, shown above, with watertight plugs and receptacles for making connections to the derrick floor.

and cathead pushbuttons, and the foot-operated spin-out switch. All these derrick floor items are oil-immersed or of explosion-resisting construction. A gasketed, weatherproof meter cabinet is provided for the driller's guidance. This cabinet houses an ammeter for each of the five main motors. The meter dials are colored to indicate loads below and above full load. A voltmeter indicates the speed in rpm of the rotary table.

Drilling operations are simplified by providing only three control handwheels. No. 1 for the No. 1 mud pump (regardless of which of the three pumps may be in operation as the No. 1 pump); No. 2 for the No. 2 mud pump (if in operation), or for hoisting, whether it be during a drill-up operation or for full-power hoisting; and No. 3 for the table rotation. This relationship of handwheel to function is maintained at all times, except for some very unusual set-ups that are possible in emergencies.

All drilling operations can be shut down instantly by means of an emergency stop button. The drill-hoist pushbuttons provide for changing from drilling, pumping and rotating operations—to hoisting.

The drill-up button assigns one generator, the one that may be supplying power to the No. 2 mud pump, to the drawworks motor for hoisting. Various additional drill-up setups may be made at the main control structure, to provide more power for hoisting or for pumping, as the case may require.

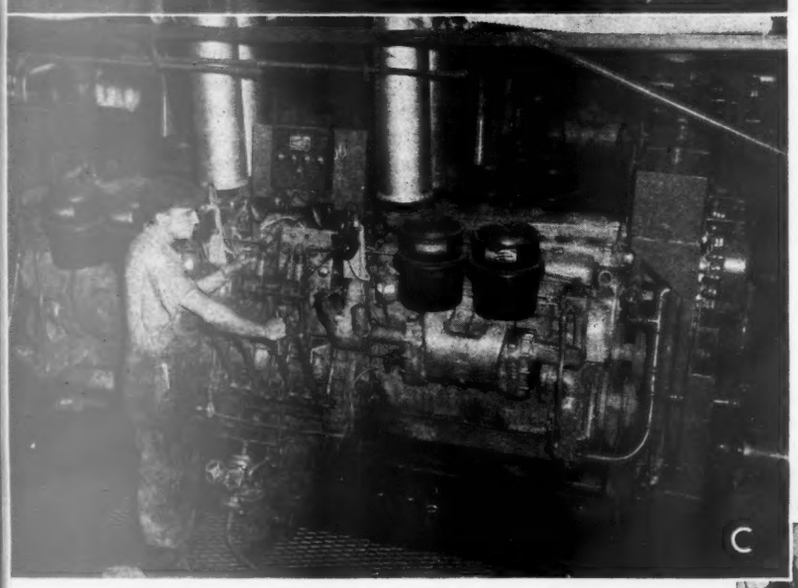
When coming out of the hole with the controls set for hoisting, a joint is spun out quickly, after breaking with the tongs and cathead, simply by stepping on the foot-operated spin-out switch. The handwheel that controls the table motor is pre-set at about ⅓ full-on position. The electrical function accomplished here is simply a momentary transfer of a generator from the drawworks motor to the table motor.

The cathead button makes it possible to operate the drawworks motor to drive the cathead simultaneously with the operation of the rotary table motor, and from the same main generator.

A special safety feature is provided on the mud pump control. It was considered desirable to prevent automatically the restarting of a pump after each stop until starting was "cleared" by the pump room attendant. This was accomplished simply by providing a reset pushbutton that the attendant must operate before the driller can restart the pump. A separate start-stop pushbutton at each pump, suitable for locking in the off-position, provides positive safety for maintenance personnel. Telephone and audible signal communication is provided between the derrick floor and engine room.

Performance

In this d-c adjustable varying-voltage system, the motor performance is dictated by the generator terminal characteristics. Fig. 2, which illus-



STEWART & STEVENSON G

Stewart & Stevenson is proud to be taking a prominent part in the gigantic offshore drilling program now in full swing.

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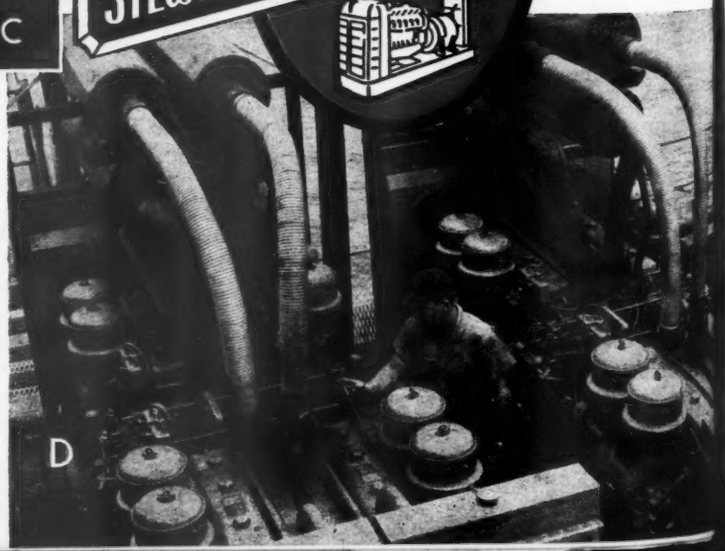

A. *Aerial view of one of the largest offshore drilling rigs. Platform houses all equipment and quarters for personnel.*

B. *Interior view of engine room of tug servicing offshore drilling location. Engines are GM Series 6-71. Each engine develops 165 horsepower.*

C. *Two GM Diesel Quads power mud pumps. Note that heat exchangers instead of radiators are used. This is a typical Stewart & Stevenson marine engine installation.*

D. *Two GM Diesel Quads power the draw works on the rig floor . . . Another typical Stewart & Stevenson installation.*

GOES TO SEA...

with the world's leading oil companies

This map shows offshore locations which are powered by GM Diesel engines furnished by Stewart & Stevenson Services. The crew boats as well as many of the tenders and tugs are also powered by GM Diesels furnished and installed by Stewart & Stevenson Services.

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1. **ENGINEERED INSTALLATION:** Stewart & Stevenson engineers recommend the best engine for the purpose. Our factory is available for the design and fabrication of the substructure, drives, and other necessary auxiliaries and our factory-trained engineers make sure the engines are properly installed.

2. **GUARANTEED PERFORMANCE:** Stewart & Stevenson engineers and factory-trained servicemen are on the location making sure that the installation is complete and the engines operating at top efficiency.

3. **GM DIESEL POWER:** GM Diesels feature high horsepower, compactness, parts interchangeability, and great dependability as well as true diesel fuel economy. All these features are extremely important in offshore operations. They are available in a complete range of sizes up to 800 horsepower per unit and their extra flexibility makes them especially suited for either marine or drilling use.

4. **QUICK SERVICE:** A factor of utmost importance in the selection of Stewart & Stevenson Services and GM Diesel Power by many of the world's leading oil companies is the Stewart & Stevenson service department.

The Stewart & Stevenson block assembly exchange plan backs up the dependability of GM Diesels and gives the results of a complete overhaul in hours instead of days.

In addition there are conveniently located service points at Port Arthur, Houston, Corpus Christi and McAllen. Stewart & Stevenson servicemen are backed by the largest distributor stock of GM Diesel parts anywhere. They drive fast, completely equipped panel trucks. They get there faster and have the parts to do the job when they arrive.

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trates the many possible v-amp generator characteristics, might also be given speed and torque scales to illustrate the corresponding speed-torque performance of the motor—motor speed varying with voltage and motor torque with amperes. There are just as many motor speed-torque characteristics available as there are generator v-amp characteristics. The power developed by the motor is determined by the total generator capacity connected to it. Thus, a 500-hp mud pump motor that takes power from a single 400-kw generator will develop 500 hp. The 800-hp drawworks motor, when taking power from three 400-kw generators for hoisting, will develop a peak output approximating 1575 hp.

Fig. 3 shows the full power performance of a 500-hp mud pump motor, and Fig. 4 illustrates the speed-torque performance of the 800-hp drawworks motor when taking power from one or two generators, as it may do during drill-up operations, or from three generators for full power hoisting. Although the rating of two 400-kw generators is comparable to that of the 800-hp drawworks motor, a third generator is made available for hoisting. This provides appreciably higher hoisting speeds at heavy load. For example, at 160 per cent full load motor torque—a maximum value that may be used for normal steady hoisting—the motor speed with two generators is 515 rpm while with three generators it is 656 rpm—a 25 per cent higher hoisting speed. The motor is capable of operating at the higher speed. The overloads are permissible, because the load is intermittent.

The use of the third generator makes it possible to overload the drawworks motor, but the driller is warned of such overloading by the ammeter and an automatic audible alarm. He never loses control, however, by the automatic interruption of power. The drive ratios from motor through drawworks provide adequate stalled torque in low-low at the maximum permissible momentary stalled torque of the motor. This matches what is safe for the mechanical equipment including line and drill pipe.

Fig. 5 shows the speed-pull characteristics of the hook, corresponding to the motor speed-torque characteristics of Fig. 4.

Auxiliary equipment

Four 75-kw, 125-v, 1450 rpm d-c generators, duplicate and interchangeable, supply all auxiliary power. Three of these generators are mounted on the main generators, but the fourth is driven separately, direct-connected to a small diesel engine. This fourth unit supplies power for any auxiliary use when the main engines are shut down. During normal service it may be used simultaneously with the other three for extra power, or may be used to carry the load of any one of them.

The auxiliary load, in addition to that for excitation and control, is made up of lighting, communication system, "household" items, and many motors. The household items include a galley hot plate, refrigerator, deep freeze unit, and water coolers.

TABLE II

Auxiliary power circuits.

Circuits	Load
2—Barge lighting	15 kw total
1—Derrick floor lighting	5 kw
1—Derrick floor auxiliaries	4 kw
1—Dynamatic drawworks brake	6 kw
1—Water distillation unit—pump	7½ hp
1—Water distillation unit—heater	6 kw
1—Whirley crane	3 motors—40 hp total
1—Anchor winches	4-25 hp motors
1—Mud mixing pump	60 hp
6—Blower motors	3 hp each
2—Shale shakers	2 hp each
3—Lube oil purifiers	1 hp each
2—Raw water circulation pumps	15 hp each
2—Sanitary water pumps	2 hp each
1—Fuel oil centrifuge	1½ hp
2—Ballast water transfer pumps	7½ hp each
1—Fuel oil transfer pump	¾ hp
1—Air compressor	7½ hp
1—Exhaust blower	3 hp
1—Machine tools	1½ hp
1—Salt water service—wash down pump	20 hp
7—Spare	5 hp each
1—Drinking water pump	1 hp

Disconnecting no-fuse breakers are supplied on the dead-front control panel for twenty-three auxiliary motors. In addition, there are breakers for circuits for lighting, water distillation unit, whirley crane, winch motors and drawworks brake. There is also a transfer switch for connecting the welder to any auxiliary generator. A number of spare breakers are provided. Auxiliary loads are listed in Table II.

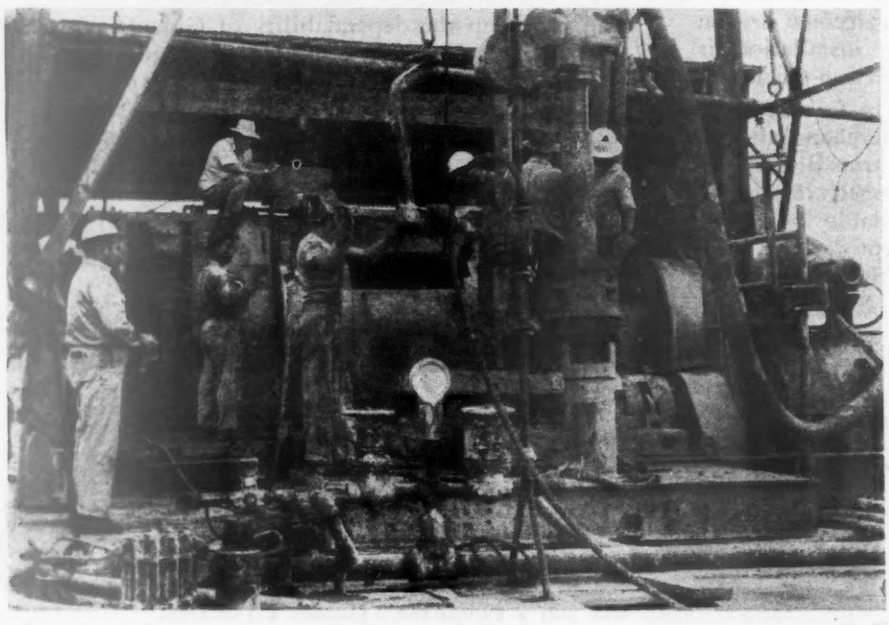
An important item on this drilling rig is the 150-gal-per-hr compression distillation unit. It distills water suitable for drinking or engine cooling from lake water.

The barge is held in place when drilling by means of four mud anchors, one at each corner. Each anchor winch has a marine-type 25-hp motor and speed regulating control. Dual master controllers are provided for each motor, one located at the winch, the other on top of the office-galley house. A controller switch mounted at the winch determines whether the winch controller or the house-top controller operates the winch. All four anchor lines are visible from the house top.

A whirley crane is mounted on a track on the house deck. It may be moved across the deck to serve either side of the barge. It is equipped with three motors and controls of 5-hp, 10-hp and 25-hp ratings for powering swing, boom, and hoist operations respectively. This crane on the drilling barge eliminates the necessity of using crane-equipped supply barges.

The "Queen," as this barge was promptly dubbed, has completed a "shakedown" trial on its first well. Native drillers and crews under the supervision of a "States" tool pusher, operated the drilling equipment with very little difficulty. ★ ★ ★

Venezuelan drilling crew "going in." The driller has charge of all operations by means of three handwheels at his left, push-button station left of his head and foot switch at his right foot.



Here's why you get Better Performance and Longer Life with an EMSCO Slush Pump

FABRICATED STEEL POWER END. Fabriform construction provides an extremely rigid, strong and compact unit. Steel skids, built integral with the power frame, considerably reduce pump weight and overall dimensions.

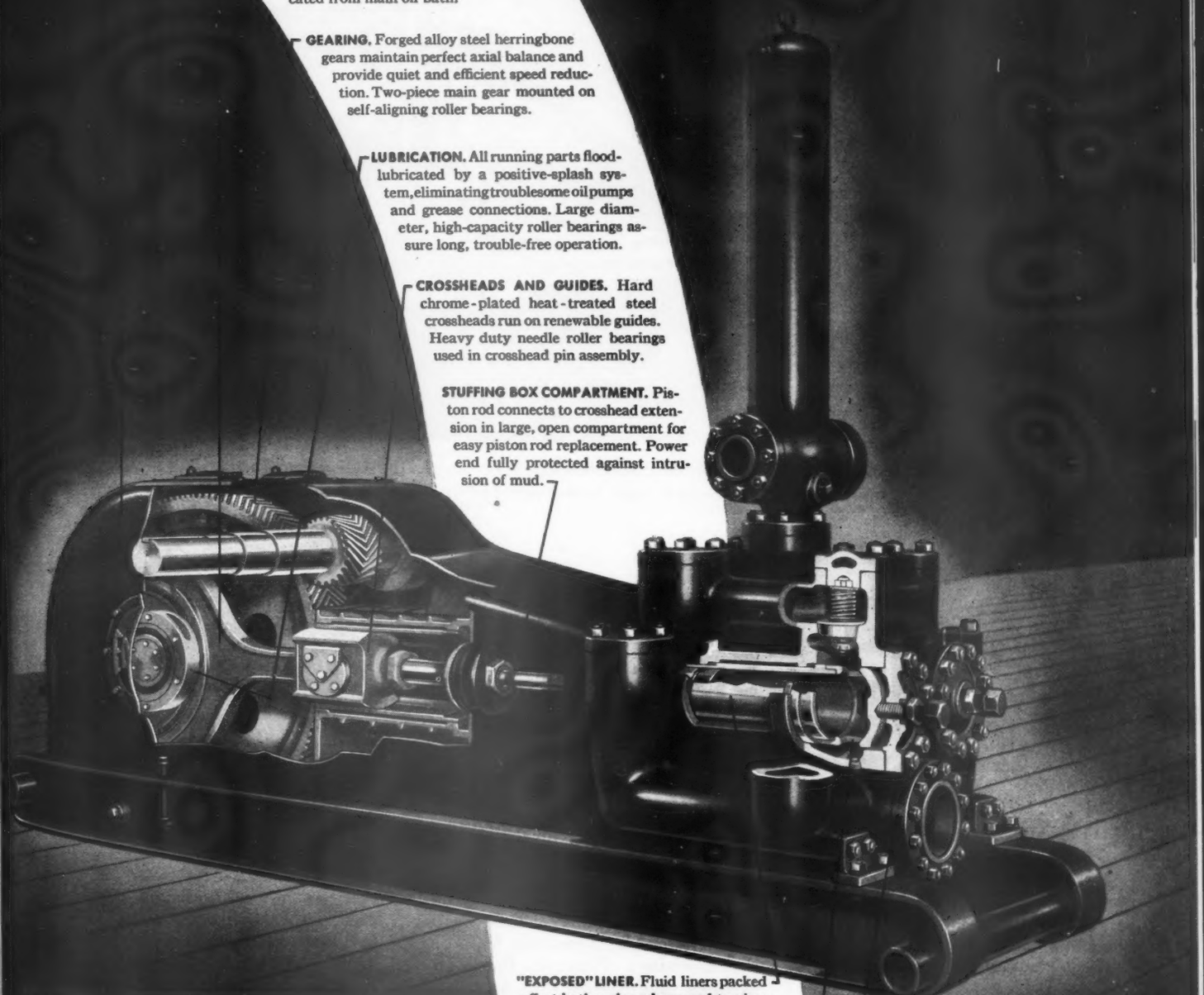
ECCENTRIC ASSEMBLY. One piece eccentric strap equipped with roller bearings at both ends assures quiet, efficient and trouble-free operation. Entire assembly is flood-lubricated from main oil bath.

GEARING. Forged alloy steel herringbone gears maintain perfect axial balance and provide quiet and efficient speed reduction. Two-piece main gear mounted on self-aligning roller bearings.

LUBRICATION. All running parts flood-lubricated by a positive-splash system, eliminating troublesome oil pumps and grease connections. Large diameter, high-capacity roller bearings assure long, trouble-free operation.

CROSSHEADS AND GUIDES. Hard chrome-plated heat-treated steel crossheads run on renewable guides. Heavy duty needle roller bearings used in crosshead pin assembly.

STUFFING BOX COMPARTMENT. Piston rod connects to crosshead extension in large, open compartment for easy piston rod replacement. Power end fully protected against intrusion of mud.



"EXPOSED" LINER. Fluid liners packed off at both ends and exposed to view. This patented construction permits immediate and unfailing detection of mud leakage before serious washouts can occur. Liners can be easily removed as they cannot become locked by sand.

DIRECT FLOW DESIGN. Full openings and large passages permit free, unobstructed fluid flow. This direct flow design assures low fluid velocities and highest volumetric efficiency.

CAST STEEL FLUID END. Electrically welded, cast-steel fluid end provides maximum strength with minimum weight. The all steel construction of the fluid end permits repairs to be made in the field by the utilization of welding.

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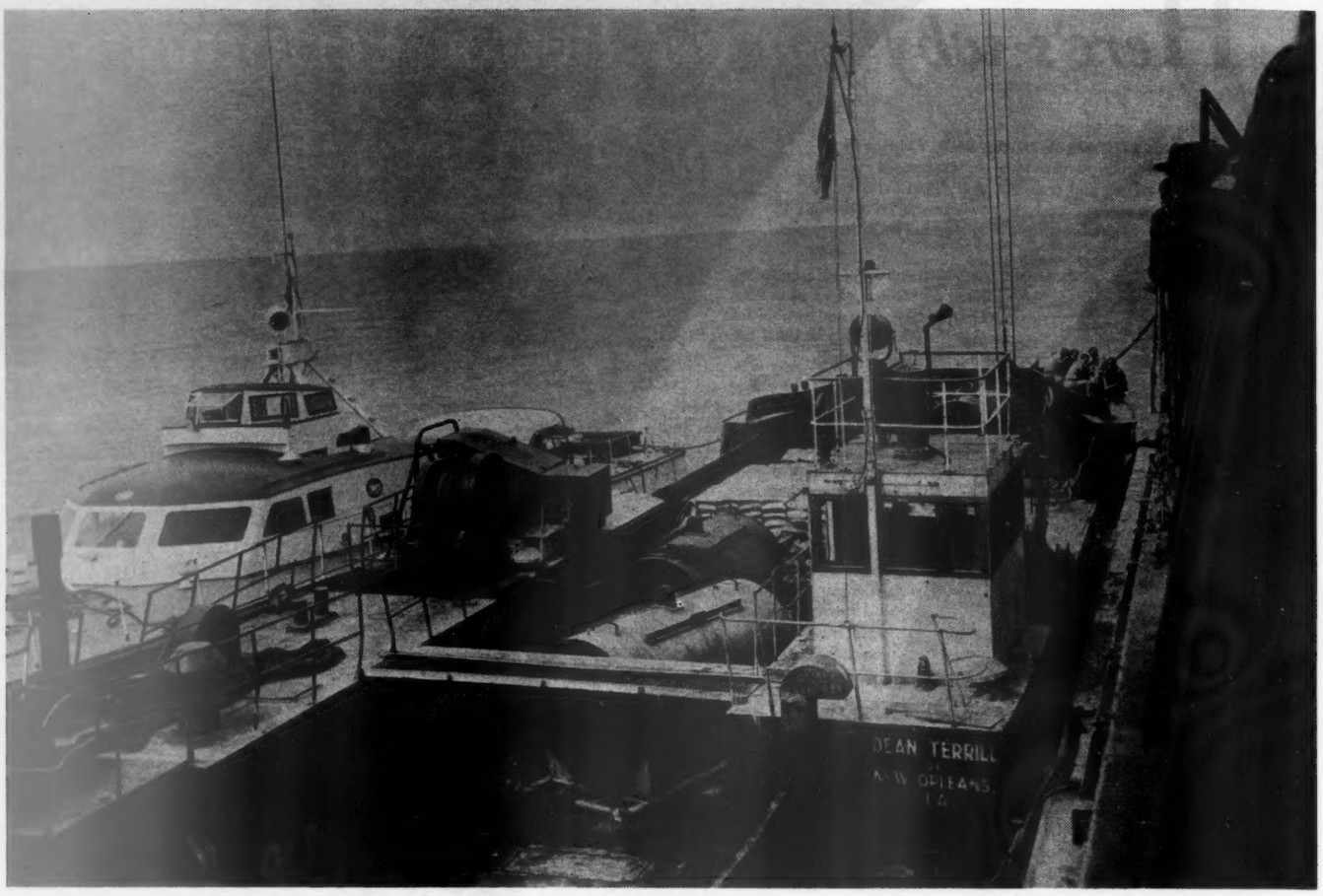


Part of Kerr-McGee fleet alongside converted Navy YF barge. The LCT, *Dean Terrill*, is used for transporting pipe, cement, and heavy supplies to the drilling rig in the Gulf.

Gulf Activity Spurred by 11 Discoveries

DEAN A. McGEE*

SUCCESS of the current drilling campaign in the Gulf of Mexico off the Louisiana and Texas coasts has served to further strengthen the faith in the potentialities of the tidelands area.

The continental shelf area, consisting of some 51,000 square miles off the Louisiana and Texas coasts, long has been regarded as favorable for oil and gas production. Superior Oil and Pure Oil Companies proved the existence of oil under the coastal waters with discovery of the Creole field in 1938. The present exploration, leasing and drilling campaign began, however, about four years ago. Since that time more than 2,000,000 acres of submerged land has been leased by the Louisiana Minerals Board for bonuses aggregating in excess of $18,000,000.

The current development program has resulted in the discovery of eleven fields in the Louisiana coastal waters. Seven of these are oil fields, three are gas condensate fields, and one is a dry gas field. In addition, several tests have encountered favorable showings of oil or gas or both.

There are now some 29 active operations in the Louisiana tidelands area, either drilling, rigging up, or building platforms preparatory to drilling. Many companies conducted extensive geophysical campaigns during 1948, and such work continues at a rapid pace. Seventeen reflection type seismographs are now working off the Louisiana coast. Exploration has progressed in some cases beyond the 27 marine mile seaward boundary claimed by Louisiana.

Drilling operations are now being conducted off the Louisiana coast by nine companies. Humble Oil and Refining Company has ten operations on the active list, Magnolia Petroleum

*Executive vice president, Kerr-McGee Oil Industries, Inc. (See Petroleum Profile, page A-60.)

EXCLUSIVE

Baash-Ross News

BAASH-ROSS TOOL COMPANY · LOS ANGELES · HOUSTON · NEW YORK

OUR 29th YEAR

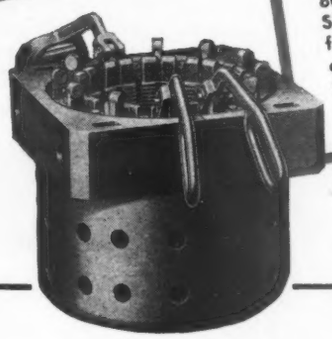
Why not run your casing with the same simplicity, speed and convenience as you do drill pipe?

Here's how.. with the BAASH-ROSS SPLIT ROTARY TABLE CASING BUSHING

Did you know that you can run casing jobs with the same ease, convenience and simplicity with which you run your drill pipe? All that you need is a Baash-Ross Split Rotary Table Casing Bushing which replaces the regular master bushings in the rotary table and permits casing to be run *through the table* with the crew working at the same convenient height and in the same efficient manner as when handling drill pipe. Here's all you do...

1 Simply lift out the regular master bushings, drop in the Split Casing Bushing and lock the table. The Split Casing Bushing is thus solidly supported and properly centered over the hole so that you can run casing with the same ease and with the crew working at the same convenient height as when running drill pipe.

2 For large diameter casing, the larger sizes of Baash-Ross Type "UC" Casing Slips can be seated directly in the bore of the Split Bushing. As outlined below, "UC" Casing Slips insure a uniform full-circumferential grip on the casing that eliminates risk of damaging the thin casing walls through concentration of slip pressure.



3 For smaller sizes of casing, drop in a split and hinged Slip Adapter which is tapered on both sides and sets flush with the top of the Casing Bushing. Removable handles permit quick and convenient insertion of the split and hinged Slip Adapter.

4 With the Slip Adapter in place, Baash-Ross Type "UC" Casing Slips to fit smaller sizes of casing can be set directly into the tapered bore of the Slip Adapter, thus permitting a wide range of casing jobs to be run with equal efficiency.

Handles Wide Range of Casing Sizes

Rotary Bore	Maximum Casing Size
27½" Dia.	21½" API
24½" Dia.	18⅝" API
20½" Dia.	16" API
17½" Dia.	13⅜" API

Modern rotary tables are able to support even the longest and heaviest casing strings with ample safety, and the Split Rotary Table Casing Bushing is ruggedly built to withstand the same service. Yet it is light in weight and readily portable in small tool cars.

The maximum casing size handled by the Casing Bushing is determined by the diameter of the opening through the rotary table. The accompanying chart shows the largest casing size that will pass through the Casing Bushings made for various size rotaries.

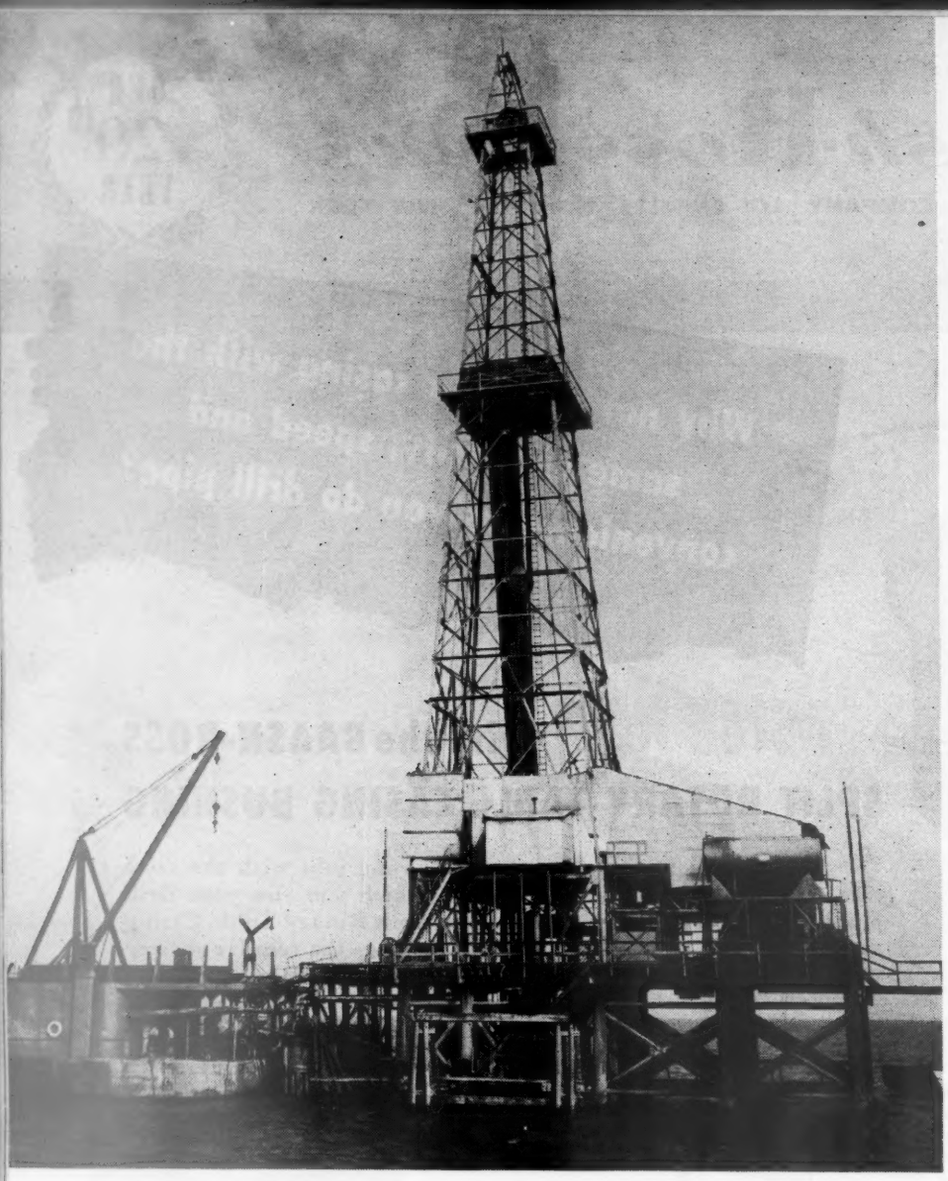
Type "UC" Casing Slips

Type "UC" Casing Slips Insure Maximum Safety in Modern Casing Operations

Baash-Ross "UC" Casing Slips are the most modern advancement in slips for handling casing strings. Because they consist of many narrow slip segments flexibly linked together, they *w-r-a-p* around the casing for a uniform, full-circumferential grip, thus insuring greater safety and maximum gripping efficiency on the relatively thin walls of casing strings. Their easily-renewable liners provide long life and low maintenance, and they have many other unique features. For more details see page 276 of the 1947 Composite Catalog.

Baash-Ross Split Casing Bushings are available domestically through leading supply stores.

For export orders write direct to Baash-Ross Tool Co., 11 W. 42nd Street, New York, N. Y.



Drilling operations underway at deepest test drilled in offshore area, Block 28 well. It was carried to 14,451 ft.

Company has five, Kerr-McGee Oil Industries, Inc. has three, the California Company four, Stanolind Oil and Gas two, Shell Oil Company two, and Superior Oil, Pure Oil, and Barnsdall Oil Companies one each.

Eleven Discoveries

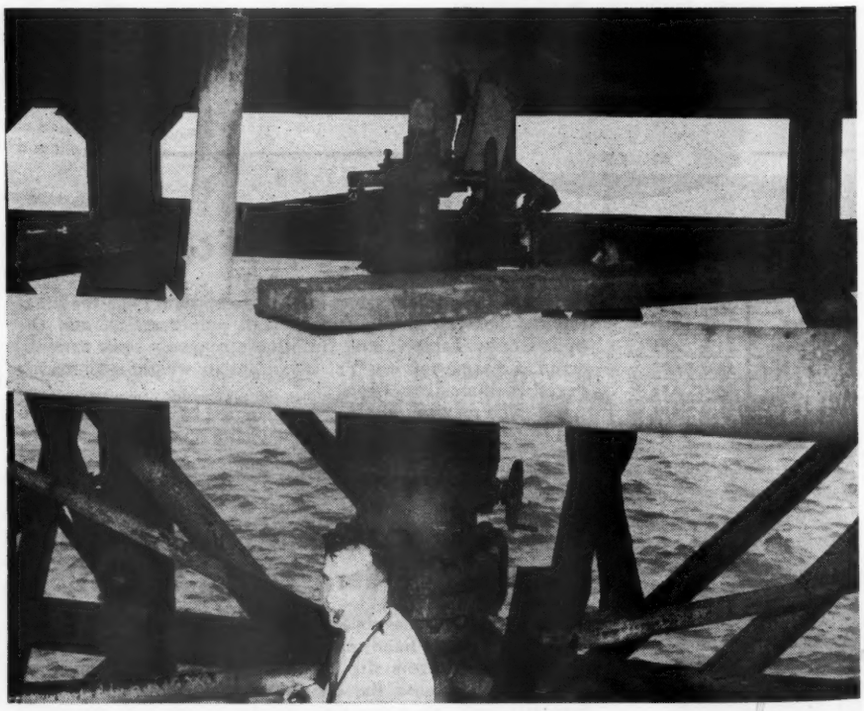
After development of the Creole field, one and one-fourth miles off Cameron Parish, by Superior and Pure in 1938, interest seemed to lag in the submerged areas for some time. Activity began in earnest about 1945, and the first commercial well in the current campaign was the Kerr-McGee-Phillips-Stanolind test on Block 32, Ship Shoal area, off Terrebonne Parish. It was drilled to 2563 ft, perforated with 256 shots at 1734-50 ft, and completed for 897 bbl of 25.3 gravity oil through a ½-in. choke on November 17, 1947. Four other holes have been drilled from same platform.

The California Company's well on State Lease 1278, Block 69, Main Pass area off Plaquemines Parish, was the second oil discovery. It was drilled to 9245 ft, perforated with 54 shots at 5848-57 ft, and completed August 10, 1948, for 205 bbl of 26 gravity oil through a 5/32-in. choke, with tubing pressure of 660 psi and a gas-oil ratio of 250 to 1.

Humble Oil and Refining discovered the third oil field only five days after the California well was completed. It was on State Lease 801, Block 18, in the Grand Isle area off Jefferson Parish. The well was drilled to 8951 ft, perforated with 250 shots at 8640-65 ft, and flowed 806 bbl of 30.9 gravity oil through a ¼-in. choke with tubing pressure of 1350 psi and a gas-oil ratio of 570 to 1.

The fourth oil field was opened by Humble with its No. 1 Caminada Pass well, Block 16, in the Grand Isle area on November 28, 1948. Perforated at 4584-96 ft, the well flowed 182 bbl of 37.6 gravity oil through a 5/32-in. choke, with a tubing pressure of 840 psi and a gas-oil ratio of 487 to 1.

Humble's No. C-1 on Block 19, Grand Isle area, is regarded generally as an extension. It produced 625 bbl of 35.7 gravity oil through a 7/32-in. choke after perforating at 9221-36 ft, and was completed on December 15, 1948, with a gas-oil ratio of 609 to 1. (See Table 1 for data on the three most recent oil field discoveries.)



Christmas tree of Block 32 well, below the platform. Company official shows how valves are operated. K. Marshall Fagin, a Petroleum Engineer editor, is in foreground.

Tornado!

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Despite its tremendous power and reserve, the Tornado is an easy rig to handle. With control at his fingertips, the driller is always in command. His job is made still easier by automatic self-adjusting clutches.

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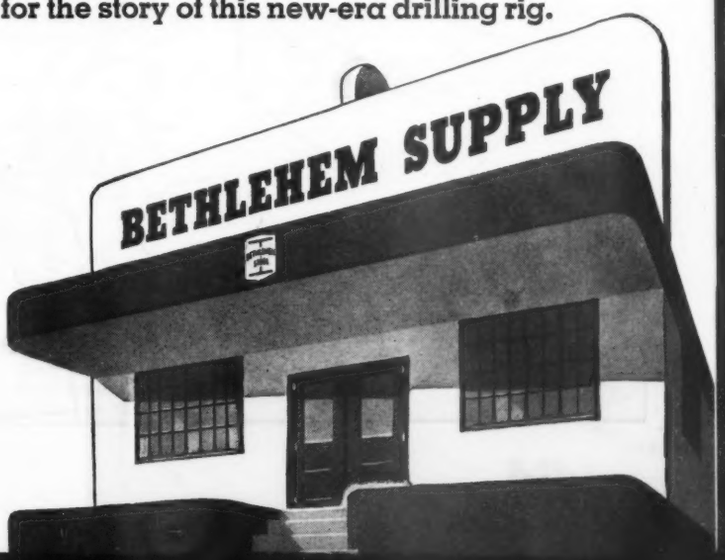

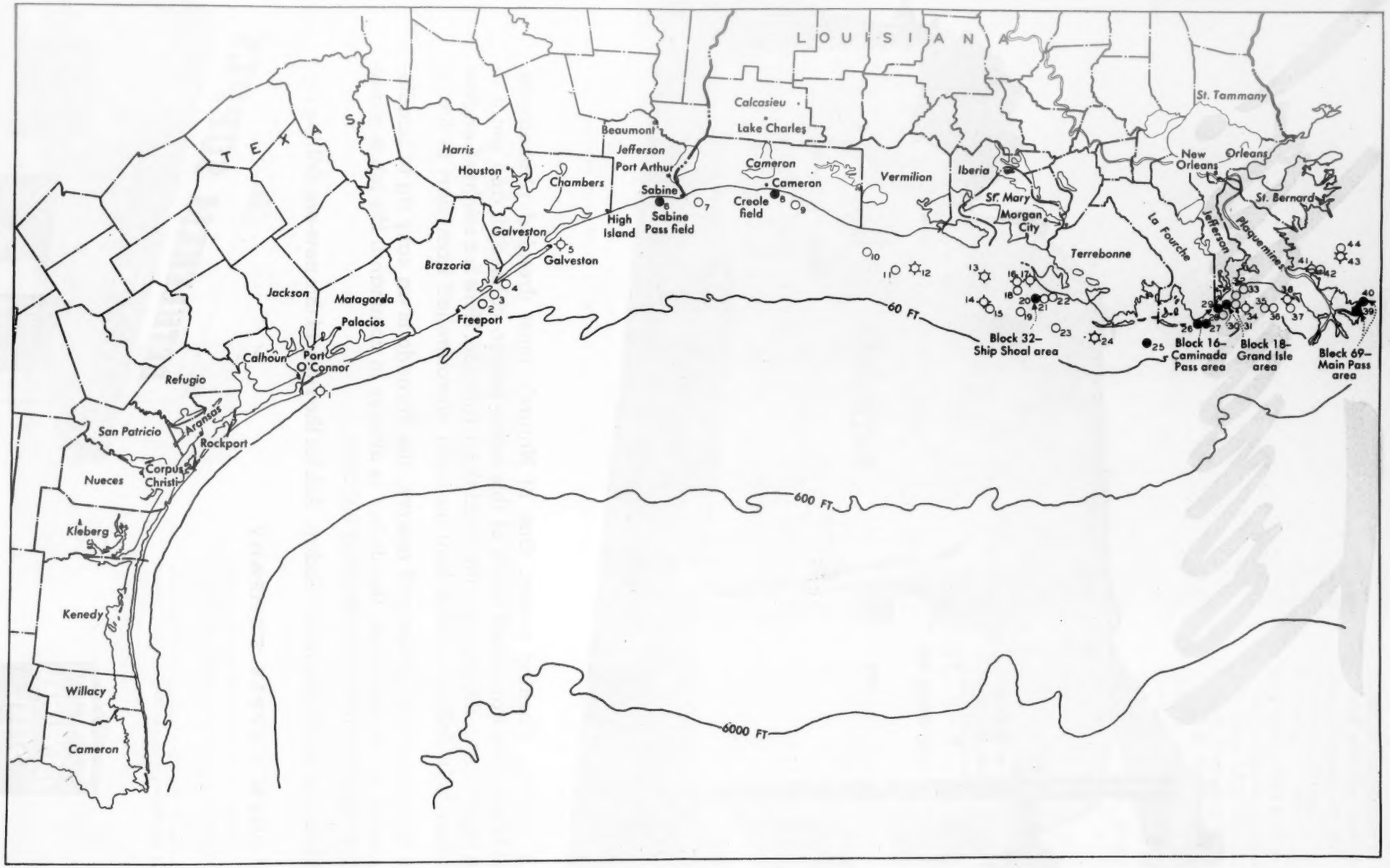

Texas and Louisiana Gulf Coast including both completed wells and drilling operations with numbers for each keyed to descriptive list on opposite page. New producers are: No. 25 in Block 34, South Timbalier area; No. 26 and No. 27 in Blocks 3 and 2, respectively, Bay Marchand area, and No. 39 in Block 69, Main Pass area. Lines indicate extent of Continental Shelf.

TABLE 1
Louisiana-Texas offshore drilling.

Key numbers correspond with map

Key No., Operator, Location, Result or Status (March 17)

1. Tidelands-Superior, State tract 483, Matagorda County, Texas, total depth 8277 ft; dry and abandoned.
2. Humble, State tract 278, Brazoria County, Texas, total depth 10,224 ft; sidetracked at 1951 ft; drilling 6732 ft.
3. Ohio Oil, State tract 248, Brazoria County, Texas, total depth 8888 ft; fishing.
4. Ohio-Stanolind, State tract 245, Galveston County, platform.
5. Stanolind, State tract 144, Galveston County, Texas, total depth 1741 ft; dry and abandoned.
6. British-American, Sabine Pass field, Jefferson County, Texas; discovery well: total depth 6721 ft, produced from 4980 ft, made 11,500 bbl oil; one other hole drilled from same platform; 6762 ft dry hole drilled from another platform.
7. Stanolind, block 45, West Cameron area, Cameron Parish, Louisiana, total depth 9728 ft, sidetracked at 2792 ft, drilling in sidetrack hole at 7650 ft.
8. Superior-Pure, Creole field, Cameron parish; discovery well: total depth 9394 ft, producing depth 5095-5115 ft; initial production discovery well 200 bbl daily; 19 holes drilled from same platform, one drilled from another platform; field has produced about 2⅔ million bbl oil.
9. Kerr-McGee et al, block 33, West Cameron area, Cameron Parish, drilling 9300 ft.
10. Pure Oil, block 39, Vermilion area, Vermilion Parish, Louisiana, total depth 8888 ft; sidetracked for No. 1-A, which was drilled to 9103 ft; No. 1-B coring at 8184 ft.
11. Superior, block 76, Vermilion area, Vermilion Parish, drilling 9970 ft.
12. Superior, block 71, Vermilion area, Vermilion Parish, total depth 13,629 ft; producing depth 9608-18 ft, made 5911 Mcf gas with 52 bbl condensate; now temporarily abandoned; second gas well completed from same platform.
13. Magnolia, block 45, Eugene Island area, Iberia Parish, Louisiana, total depth 13,636 ft; producing depth 11,351-58 ft; 34,500 Mcf gas, 52 bbl condensate.
14. Magnolia, Block 94, Eugene Island area, Iberia Parish, total depth 2613 ft; dry and abandoned.
15. Magnolia, Block 110, Eugene Island area, Iberia Parish, total depth 10,748 ft, drilling at 9880 ft in sidetracked hole.
16. Magnolia, block 77, Eugene Island area, St. Mary Parish, Louisiana, total depth 3715 ft, dry and abandoned; two other dry holes drilled from same platform.
17. Magnolia, block 58, Eugene Island area, St. Mary Parish, total depth 12,874 ft, dry and abandoned.
18. Magnolia, block 77, Eugene Island area, St. Mary Parish, well No. 2 drilling salt at 9680 ft. Top salt 7690 ft.
19. Magnolia, block 125, Eugene Island area, St. Mary Parish, drilling at 3040 ft.
20. Kerr-McGee et al, block 32, Ship Shoal area, Terrebonne Parish, Louisiana, discovery well: total depth 2563 ft, producing depth 1734-50 ft, initial production 897 bbl oil; four other holes drilled from same platform.
21. Kerr-McGee, block 33, Ship Shoal area, Terrebonne Parish, drilled to 3674 ft, dry and abandoned. Top salt 3659 ft.
22. Kerr-McGee et al, block 28, Ship Shoal area, Terrebonne Parish, total depth 14,451 ft; sidetracked, 7100; drilling, 8233 ft.
23. Magnolia, block 108, Ship Shoal area, Terrebonne Parish, building platform.
24. Magnolia, block 72, Ship Shoal area, Terrebonne Parish, total depth 9355 ft; producing depth 7266-76 ft, 4800 Mcf gas, spray condensate.
25. Humble, block 34, South Timbalier area, Terrebonne parish, total depth 9926 ft, perforating and testing, flowed 125 bbl through ⅛-in. from 9550-58 ft. Gas-oil ratio was 1100 to 1.
26. California Co., block 3, Bay Marchand area, LaFourche Parish, Louisiana, first well: total depth 2131 ft, top salt 2114 ft, dry and abandoned; second well total depth 5550 ft in shale, perforated 5020-66 ft, flowed 320 bbl through 5/32-in. choke on drill stem test; testing.
27. California Co., block 2, Bay Marchand area, LaFourche Parish, total depth 3721 ft, top salt 3715 ft, flowed 255 bbl through ½-in. choke from 2873-92 ft. Gas-oil ratio was 303 to 1.
28. Humble, block 22, Caminada Pass area, Jefferson Parish, Louisiana, first platform destroyed by hurricane, rebuilding.
29. Humble, Block 16, Caminada Pass area, Jefferson Parish, total depth 8259 ft, producing depth 4584-96 ft, initial production 219 bbl oil daily; another well from same platform at 6280 ft, testing.
30. Humble, block 18, Grand Isle area, Jefferson Parish, total depth 9851 ft, producing depth 8640-45 ft, initial production 878 bbl oil daily. First test was dry at 8600 ft, redrilled; three holes completed and one drilling from same platform.
31. Humble, block 19, Grand Isle area, Jefferson Parish, waiting on rig.
32. Humble, block 9, Grand Isle area, Jefferson Parish, first platform destroyed by hurricane; building new platform.
33. Humble, block 12, Quatre Bayou area, Plaquemines Parish, Louisiana, total depth 2575 ft, drilling at 8415 ft.
34. California Co., block 34, West Delta area, Plaquemines Parish, total depth 13,968 ft, dry and abandoned.
35. Humble, block 31, West Delta area, Plaquemines Parish, building platform.
36. Humble, block 30, West Delta area, Plaquemines parish, total depth 7500 ft. Testing in sidetracked hole at 2179-82.
37. Humble, block 27, Tiger Pass area, Plaquemines Parish, Louisiana, total depth 10,136 ft, drilling 9357 ft in second sidetracked hole.
38. California Co., block 24, West Delta area, Plaquemines Parish, total depth 12,611 ft, dry and abandoned.
39. Shell, block 80, Main Pass area, Plaquemines Parish, total depth 8504 ft, perforated 5835 to 5842 ft; initial production 111 bbl on 11/64-in. choke. Gas-oil ratio 108 to 1.
40. California Co., block 69, Main Pass area, Plaquemines Parish, first well: total depth 9245 ft, producing depth 5848-57 ft, initial production 205 bbl oil daily. Three producers to date, preparing to drill fourth hole from same platform.
41. Shell, block 49, Grand Bay area, Plaquemines Parish, well No. 1, total depth 12,163 ft, dry and abandoned.
42. Shell, block 49, Grand Bay area, Plaquemines Parish, No. 2 drilling 10,400 ft.
43. Barnsdall, block 36, Breton Sound area, Plaquemines Parish, total depth 10,609 ft, producing depth 4130-42 ft, initial production 2360 Mcf gas.
44. Barnsdall, block 29, Breton Sound area, Plaquemines Parish, drilling 4767 ft.

Kerr-McGee Gulf drilling platform with warehouse barge anchored; tug, LCT, and two 85-ft crewboats alongside.

TABLE 2
Allowable for offshore wells, off Louisiana coast, effective September 24, 1948, by special order of the Louisiana Conservation Commissioner:

Depth, ft	Daily Well Allowable, bbl
2000 and above	265
2000-3000	285
3000-4000	305
4000-5000	325
5000-6000	355
6000-7000	385
7000-8000	425
8000-9000	465
9000-10,000	505
10,000-11,000	545
11,000-12,000	585
12,000-13,000	625
13,000 and below	675

Marine operating bases on Bayou Boeuf of Intercoastal Canal. Kerr-McGee-Phillips-Stanolind headquarters in foreground; Magnolia base above tanks, and then Morgan City, Louisiana.

Four Gas Fields

Superior Oil Company is credited with the first gas condensate production in the Louisiana coastal waters. Its No. 1 well on Block 71, Vermilion area, State Lease 884, off Vermilion Parish, was completed July 2, 1948, producing through perforations from 9608 to 9618 ft with a total depth of 13,639 ft. The well flowed 5,911,000 cu ft of gas through a 20/64-in. choke with a tubing pressure of 3790 psi and a gas-oil ratio of 110,838 to 1. It has been shut in.

Superior also has completed No. A-2 on Block 71, Vermilion area, through perforations at 9916-26 ft, for 22 bbl of 51.1 gravity condensate per day plus 2,369,000 cu ft of gas with a gas-oil ratio of 107,682 to 1.

The second gas condensate field was discovered by Magnolia Petroleum at its No. 1 well on Block 72, Ship Shoal area, State Lease 766, off Terrebonne Parish. Drilled to 9355 ft, and perforated with 60 shots at 7266-76 ft, the well flowed 4,800,000 cu ft of gas, with condensate spray through a 12/64-in. choke. It was completed on August 20, 1948.

Magnolia's No. 1 well on Block 45, Eugene Island area, off Iberia Parish, opened the third gas condensate field. Drilled to 13,636 ft and perforated with 24 shots at 11,351-58 ft, the well flowed 3,750,000 cu ft of gas through a 24/64-in. choke with a tubing pressure of 900 psi.

The only dry gas field opened so far was discovered by Barnsdall Oil Company on Block 36, Breton Sound area, off Plaquemines Parish. The well was drilled to 10,609 ft, perforated with 72 shots at 4130-42 ft, and flowed 2,360,000 cu ft of dry gas through a ¼-in. choke. It was completed March 23, 1948.

Deepest Well—14,451 Ft

The deepest hole drilled in the submerged area off the Louisiana and Texas coasts is the Kerr-McGee well on Block 28, Ship Shoal area, off Terrebonne Parish, which reached 14,451 ft. Good gas showings were encountered about 7600 ft and 8600 ft, but tests were not conclusive of productivity. A gas-condensate zone from 13,973 to 14,045 ft indicated production on the basis of electric log and core analysis data.

Another sand was logged at 14,062-71 ft, and the well attempted to blow out. Strong gas pressure was evident from that depth until total depth was reached. Mechanical difficulties and two tropical hurricanes combined to cause loss of the lower 7400 ft of hole. The 7-in. casing has been cut and pulled to 7164 ft. The well will be re-drilled from that depth.

Drilling Practices

Drilling in the open waters of the Gulf of Mexico now follows two general patterns, (1) large platforms on which are located the derrick and all necessary drilling equipment including crew quarters, and (2) a combination of small platform and floating barge drilling tender. The large platforms appear more practical for very shallow or very deep water. The platform-floating tender combination is

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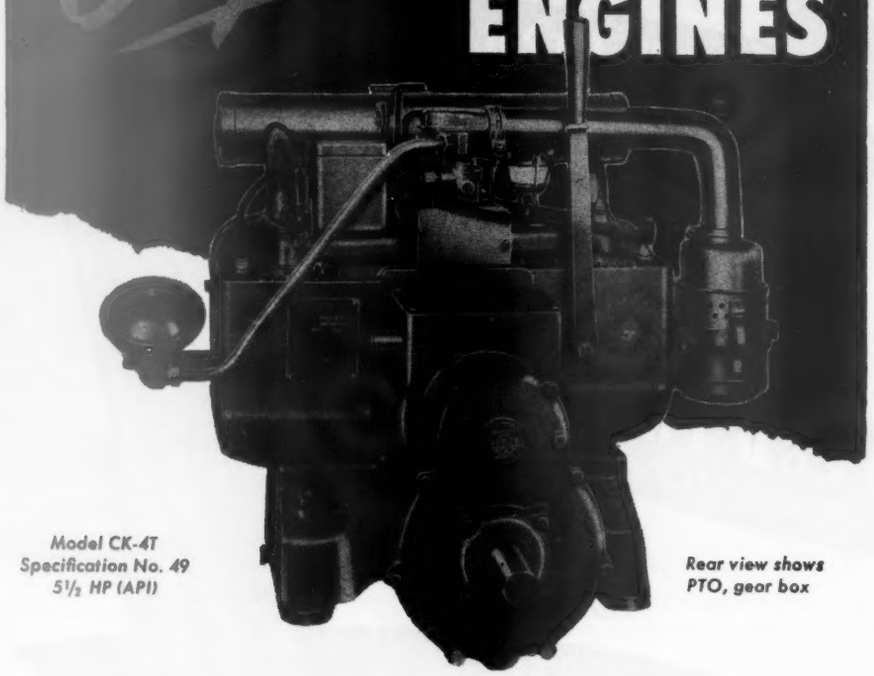

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Specification No. 49
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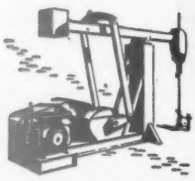

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Full pressure lubrication by gear-type oil pump. Runs on either gas or gasoline. Check with your supply house or write.

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ONAN ELECTRIC PLANTS—A.C.: 350 to 35,000 watts. D.C.: 750 to 15,000 watts. Gas-gasoline and Diesel models.

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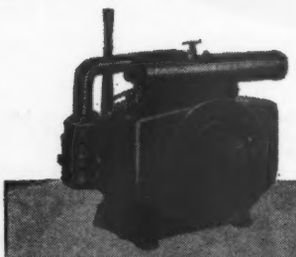

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gaining favor, however, for all other types of operations.

Methods employed are undergoing constant change, but are still very expensive and definitely limited by water depths. Most of the drilling to date has been off the Louisiana coast where there are large areas of relatively shallow water. Because of the steeply sloping ocean bottoms along the Texas coast, water depths will assume greater importance as drilling extends in that direction.

The Louisiana Conservation Commissioner has demonstrated his intense interest in establishing a permanent formula for fixing allowables that will stimulate further search for new fields and rapid development of those already discovered and, at the same time, require the application of sound conservation principles.

Higher Allowables

At a special hearing on August 24, 1948, evidence and recommendations relative to establishing well allowables in the offshore areas were received. On September 24, 1948, the Commissioner issued an order fixing maximum daily allowables on the basis of depth, giving offshore wells considerably higher allowables than those on land.

Wells 2000 ft and shallower are allowed 265 bbl daily, with 20 bbl daily increase for each 1000 ft to a depth of 5000 ft, which wells get 325 bbl daily. Then there is a 30 bbl increase for each 1000 ft of a depth to 7000 ft, which wells are granted 385 bbl. Wells 7000 to 8000 ft deep are permitted 425 bbl daily, with a 40 bbl increase in daily allowable for each 1000 ft until depth of 13,000 ft is reached, which wells get 625 bbl daily allowable. Wells below 13,000 ft deep are permitted 675 bbl daily. These allowables by depth shown in Table 2.

A large portion of the nation's oil and gas reserve is concentrated along the Louisiana-Texas Gulf coast. It is estimated that many of the fields will yield a hundred million bbl each, and a few have estimated ultimate yields as high as four or five hundred million bbl. This oil and gas production, developed on land, in the marshes and swamps, in the bays and bayous, now extends down to the water's edge all along the coast line. All geological and geophysical data indicate that equally favorable structural and sedimentary conditions exist under the water adjacent to the coast line.

Offshore Geology

Oil in the Texas-Louisiana coastal fields is produced almost exclusively

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from salt dome structures. These domes vary in character from very shallow, piercement type domes to large, deep seated salt masses. For many years it has been assumed that the salt beds, from which the domes derive their salt, extended beyond the coast line under at least a part of the continental shelf. During the past four years, seismic work off the Louisiana coast has demonstrated that salt domes, of the same general type and character as those found on land, extend out to a distance of at least thirty miles from the coast.

Exploration work now is being carried on at distances greater than thirty miles from the coast line. The United States Navy recently released gravity data indicating the presence of salt domes 75 miles from the coast and possibly beyond. All other information tends to indicate that salt domes, and consequently structural conditions favorable for the accumulation of oil and gas, are present at great distances from the Louisiana and Texas coast lines. The limiting factor in the development of these favorable prospects may be the industry's ability to devise methods and equipment for drilling wells in the relatively deep waters of the ocean where they occur.

With improvement of methods and equipment, it is believed that it soon will be practicable to drill wells in water depths up to 150 ft in the unprotected waters of the Gulf of Mexico. That area of the continental shelf covered by water to a depth of 150 ft and lying off the Louisiana and Texas coasts totals about 30,500 sq miles.

Assuming that possible producing structures occur in the ocean area with the same density as on the coastal land belt, and work to date off the Louisiana coast tends to confirm a similar density pattern, the possibilities are that crude oil recovery per sq mile of area in the ocean area will exceed that of the coastal land belt, on account of a thicker and more effective sedimentary section. It seems logical to assume, therefore, that the total oil reserve in this new province will exceed that of the coastal land area.

Oil Shipped in Barges

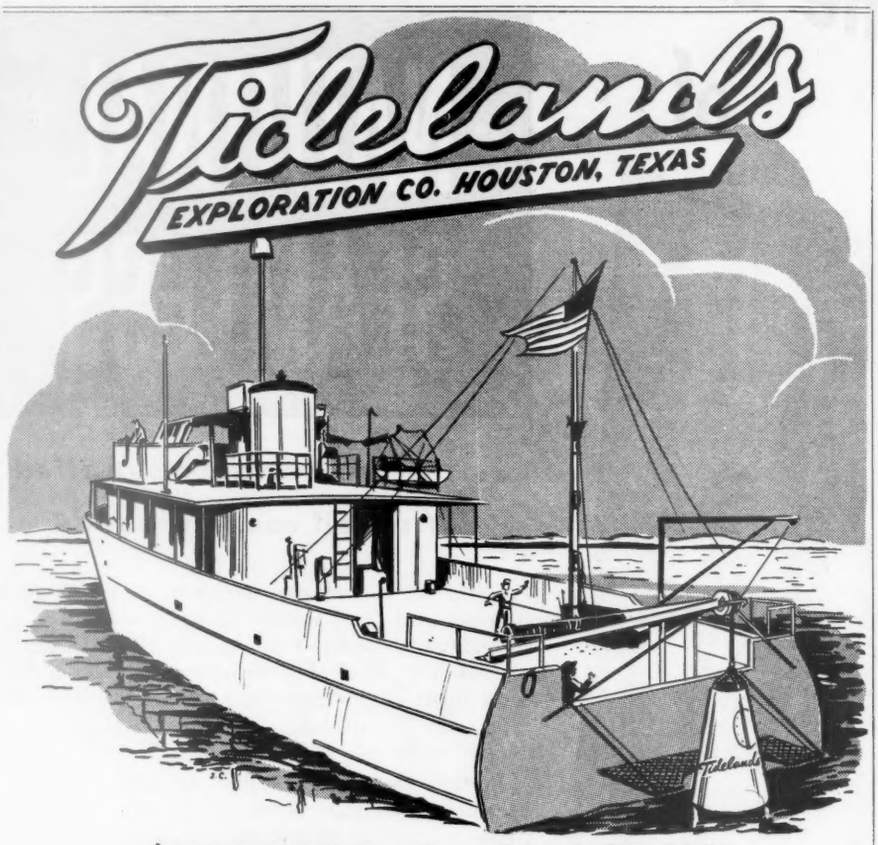
All the oil being produced from wells completed within the past three years in the unprotected waters of the Gulf of Mexico is being transported to inland terminals by barge. At Creole a 3-in. under-water line carries the oil from the platform to the shore, which is about 1¼ miles away. Construction of under-water lines has been considered by other operators, but such construction is awaiting further development.

A large number of barges are required for movement of the oil to the shore terminals. In the Block 32 field of the Ship Shoal area, for example, Kerr-McGee is using three barges to transport the oil being produced. One is usually at the location, one in transit, and one unloading at the Morgan City terminal.

Oil from the wells is produced into small separator units on the platform and then flows through a rubber hose directly into the barge which is anchored approximately 100 feet from the platform. Thus the company is producing oil from some wells while simultaneously drilling another directionally controlled hole from the same platform.

What is now happening off the Louisiana coast and to a smaller extent off the Texas coast will be reproduced on a much larger scale in many other parts of the Gulf of Mexico and in the world in years to come. The techniques, methods, and equipment that are almost daily being developed to increase the effectiveness and lower the cost of exploring, drilling, and producing these new oil fields will be invaluable in their later application to other continental shelf oil frontiers.

* * *



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Inside of Rocks Shown in Movies

ABOVE, Cinematone camera sees the face of a sample of rock taken from an underground formation. Dark shadows are holes or pore spaces in the rock. CENTER, Henry Shaefer, of the production research department at Stanolind's Tulsa research laboratories, with the machine. BOTTOM, is a close-up view. The camera is at upper left and the diamond grinding wheel to the right. Core sample being filmed can be seen in the vise-like gripper at lower center.

A NEW machine developed by Stanolind Oil and Gas Company may make it possible to take motion picture "tours" through the inside of rocks.

The device is called a Cinematome machine. Its inventors hope it will aid the study of oil-bearing rock formations. If so, it may provide some of the answers to the problem of getting more oil out of the ground.

Most oil deposits are found in porous rock formations thousands of feet underground. But the oil can be produced only if there are enough tiny holes in the rock—holes that are connected together—to let the oil droplets move through the rock layer to the well bore.

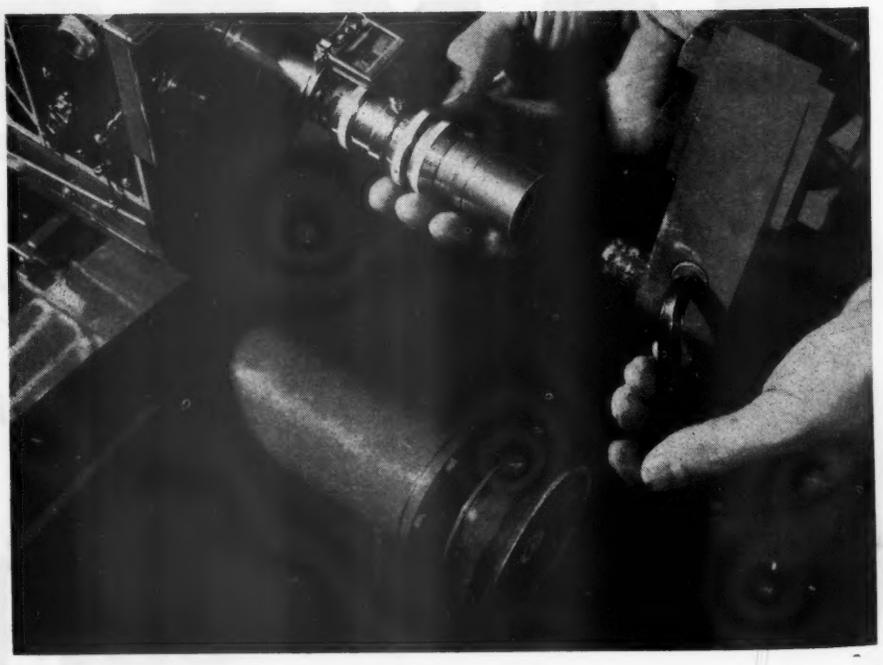
The machine is adding to scientists' knowledge of rocks and how oil might move through porous formations. By studying the pictures, scientists should be aided in visualizing the physical steps in the production of oil. They can see how oil might get trapped in dead-end pores. And they may be able to devise new ways to cut down such trapping.

The machine combines a camera and a grinder with a diamond grinding wheel. The wheel can be adjusted so that slices of rock only 1/30 as thick as a newspaper page can be removed.

The rock to be "filmed" may be a sample taken from an oil-producing formation. First, it is cleaned and saturated with a dark-colored plastic. Then, it is mounted on the machine. Successive layers of rock are removed automatically by the grinding wheel. After each layer is shaved away, a single frame picture is taken on motion picture film. When the film is run through the projector at normal speed, the rock appears to melt away. The result is something like a colored movie of a tour through a rock.

The feeding of the rock into the grinder is automatic. The machine has two electric motors: One moves the rock past the grinding wheel and into place in front of the camera; the other drives the wheel. The rock is wet while the grinding is done. Its face is dried with an air blast before each picture is taken.

* * *



Questions & Answers

about the NEW Shaffer Type 46 Combination Rotating Blow-out Preventer and Stripper

BECAUSE IT is so complete, so adaptable, so trouble-free in all types of pressure control operations, operators everywhere are asking for more information about the Shaffer Type 46 Combination Rotating Blow-Out Preventer and Stripper. Typical questions include . . .

"DOES IT REQUIRE SPECIAL STRINGS OF PIPE? *We like to simplify our operations and inventories as much as possible and are wondering if your unit requires flush joint or other special pipe."*

NO! The Shaffer Type 46 Combination Rotating Blow-Out Preventer and Stripper requires no special drill string equipment of any kind. It packs off around *any* type of pipe—coupled, upset or flush—with equal efficiency and safety. What's more, it maintains its leak-proof seal *continuously* while any type of pipe is raised or lowered through the unit!

"WHAT OPERATIONS ARE NEEDED TO PACK OFF THE UNIT? *Pressure emergencies happen fast. What operations are required to seal-off against pressure leakage around the drill string?"*

NONE! The Shaffer Type 46 Combination Rotating Blow-Out Preventer and Stripper is *always* packed off while the drill string is in the hole. No matter how sudden the pressure emergency, it can't be too fast for the Shaffer Preventer *because no operations whatever are needed to place it in operation!*

"CAN BITS AND REAMERS BE PASSED THROUGH THE UNIT *with maximum ease, safety and simplicity?"*

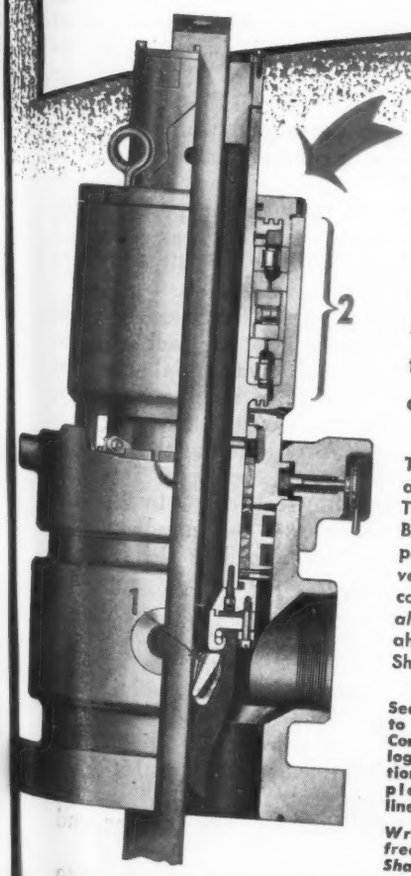
DEFINITELY YES! Just pull a latch, rotate the Bonnet 1/6th turn and the entire internal mechanism rides out on top of the bit or reamer. Simply reverse the operation when going back into the hole. It's as easy as that—*and as quick!*

"HOW ABOUT THE KELLY? *Is a special kelly needed to keep from damaging the sealing rubber?"*

NO SPECIAL KELLY IS NEEDED with the Shaffer Type 46 Combination Rotating Blow-Out Preventer and Stripper. You can use a square, hexagon or octagon kelly—whichever you prefer—and the *same* unit seals as effectively around each type. What's more, because the Stripper Rubber rotates *with* the kelly—not around it—there is virtually no wear on the Rubber while drilling. Cuts maintenance, assures better pack-off and a maximum of trouble-free safety!

. . . and note these features

There are many other unique advancements incorporated into the Shaffer Type 46 Combination Rotating Blow-Out Preventer and Stripper of which the following are typical . . .



1. EXPANDABLE STEEL BARRIER PROTECTS RUBBER. Note how the Stripper Rubber is protected by a barrier of steel latches that expands and contracts to permit normal flexure—but safeguards against extrusion or abnormal expansion.

2. ADVANCED BEARING DESIGN. Thrust and radial loads are carried on separate bearing assemblies, each specifically engineered for its particular type of service. In addition, the radial bearings are widely-spaced to provide ample resistance against wobble and gyrating loads.

These and still other unique advancements make the Shaffer Type 46 Combination Rotating Blow-Out Preventer and Stripper the most *efficient*, most *versatile*, most *positive* pressure control unit yet developed. Get all the details on this years-ahead control unit from your Shaffer representative. Or write

See pages 3843 to 3894 of your Composite Catalog for information on the complete Shaffer line.

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Limoneira No. 1, drilled by Superior Oil Company to a total depth of 18,734 ft.

New Depth Record

As this issue went to press Superior Oil Company for the second time broke its own record well depth. The Pacific Creek wildcat in Sublette county, Wyoming, pushed below 18,772 ft to gain the deepest well title. It is still drilling.

California Regains Deepest Well Record

RICHARD SNEDDON*

SUPERIOR OIL COMPANY'S wildcat well, Limoneira No. 1 in the north Montalvo area, near Ventura, California, was abandoned on March 14, 1949, when it had reached a total depth of 18,734 ft without any indication of a producing formation. This well took the world's record away from Superior's Weller No. 1 in Caddo County, Oklahoma, beating it by about 911 ft.

Drilling was halted in the Limoneira just short of the Miocene. The entire project was marked by a remarkable absence from trouble, although it was drilled with a rig that has been in service for almost nine years. Six times the drill pipe stuck but each time it was loosened and operations continued, without what could truly be called a fishing job.

Limoneira No. 1 was drilled to its final depth in just more than six months, about half as long as it took to finish the Caddo County well. The nearest approach to a fishing job occurred on February 18, 1949, when the drill pipe stuck at 18,136 ft.

Jars had been used in the string since the well had passed the 17,159-ft mark, but there was not sufficient weight above the jars to effectively release the stuck pipe. The string was therefore backed off at the safety joint, and nine 6 in.-forty foot drill collars were put on above the jars. Even with this added weight it took 8½ hr of manipulation to jar the pipe loose.

The well was spudded on September 6, 1948, with a 12¼-in. hole reamed to 17½ in.—this to a depth of 1979 ft. Surface casing 13⅜ in., was set and cemented with 1500 sacks of cement at this point. The particulars of this string are designated in the tabulation shown below:

13⅜-IN. SURFACE CASING. TYPE J-55

No. joints	Footage	Weight, lb.
7	262.09	61
9	308.21	54.5
34	1327.83	54.5
2	63.28	61.0

Below the suface string, a 12¼-in. hole was drilled to 12,030 ft. An effort was made to set 9⅝-in. casing at this level, but it froze at 11,209 ft. The section between 11,115 and 11,117 ft was then perforated with ten 1 1/6 in. holes, a cement retainer was set at 11,093 ft, and a cement squeeze job was made through the perforations. This protective string was cemented at 11,204 ft. From 12,030 to 18,734 ft the hole size was 8⅜-in.

Not much detail has been given out on the geology, but the well failed to indicate any oil commercial sands. In the early stages of drilling, however, some fine fresh water sands were encountered. As reported by the geological department, the main intervals were as follows: From 0 to 2620 ft, fresh water sand and conglomerate; 2620 to 5750 ft, mainly shale; 5750 to 18,734 ft, interbedded sand and siltstone.

Deepest Core

Five coreheads were used in the 12¼-in. hole; 14 coreheads were used in the 8⅜-in. hole. Total section cored was 290 ft for a recovery of 156½ ft, or 53.4 per cent.

Total coring time was 85½ hr, and

*Pacific Coast Editor.

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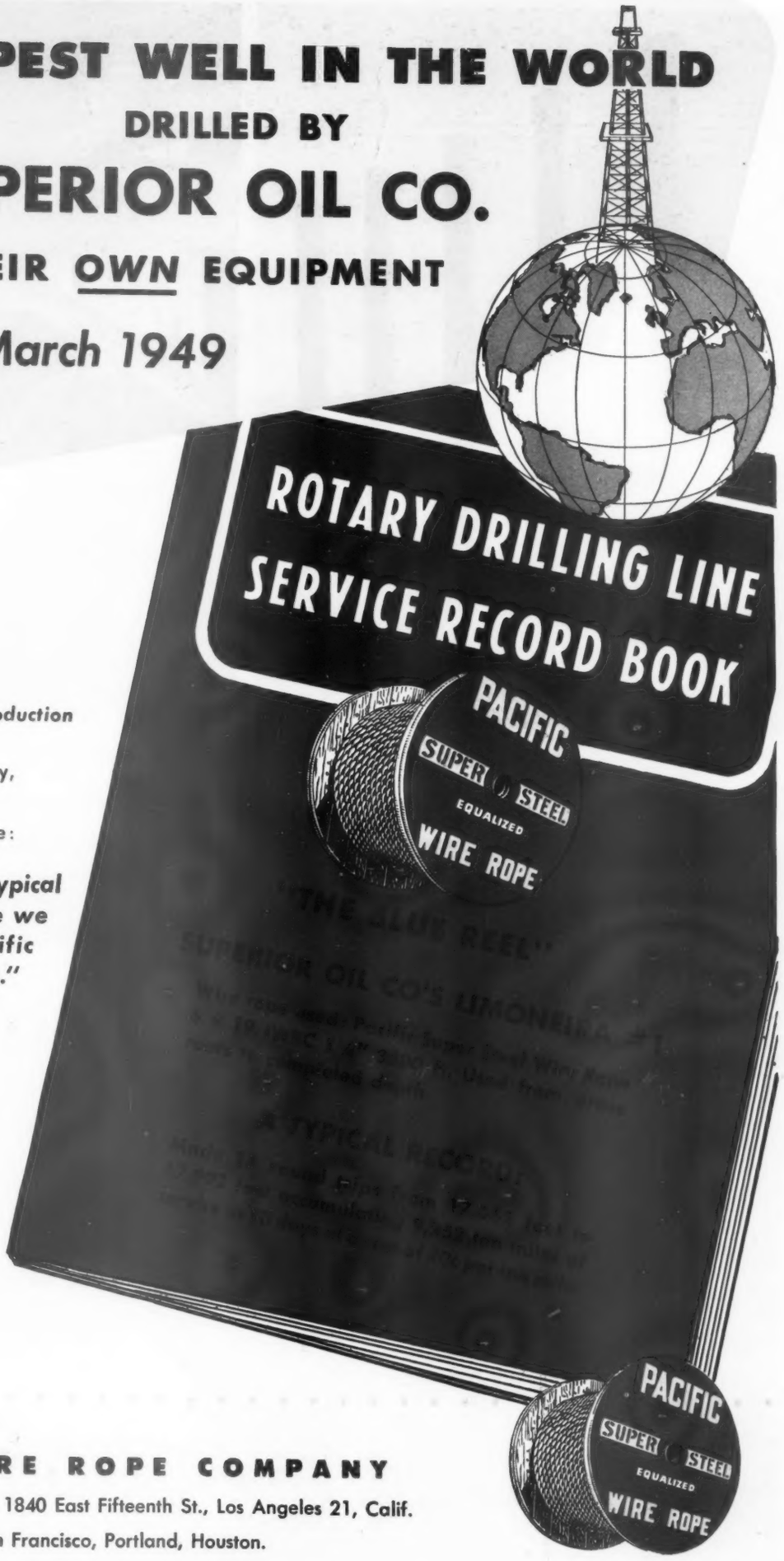
THE DEEPEST WELL IN THE WORLD

DRILLED BY

THE SUPERIOR OIL CO.

WITH THEIR *OWN* EQUIPMENT

March 1949



HERE IS WHAT
JOHN C. CODY

Vice President in Charge of Production
(PACIFIC DIVISION)
The Superior Oil Company,
has to say about
Pacific Equalized Wire Rope:

"This outstanding record is typical of the consistent service we are getting from Pacific Equalized Wire Rope."

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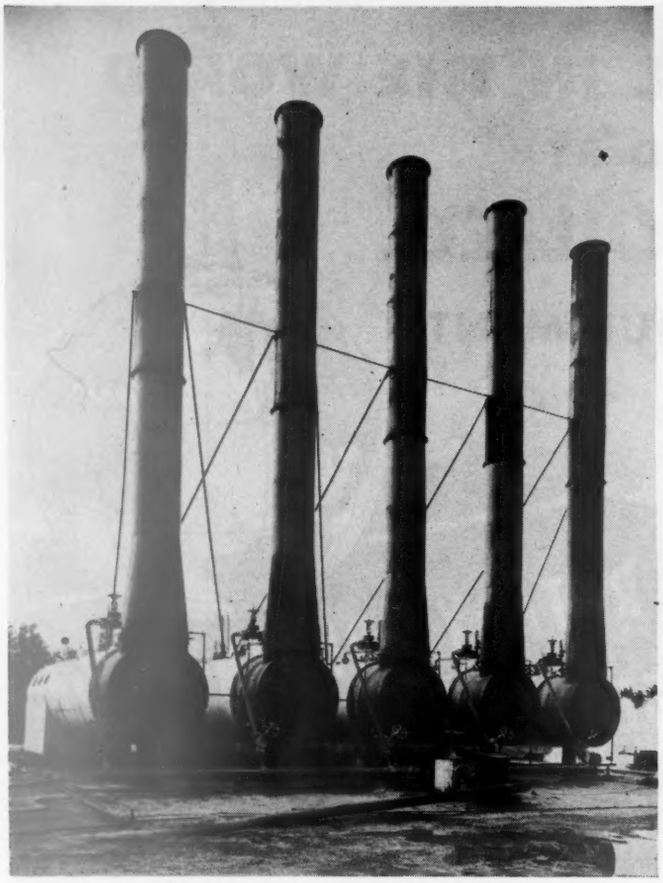
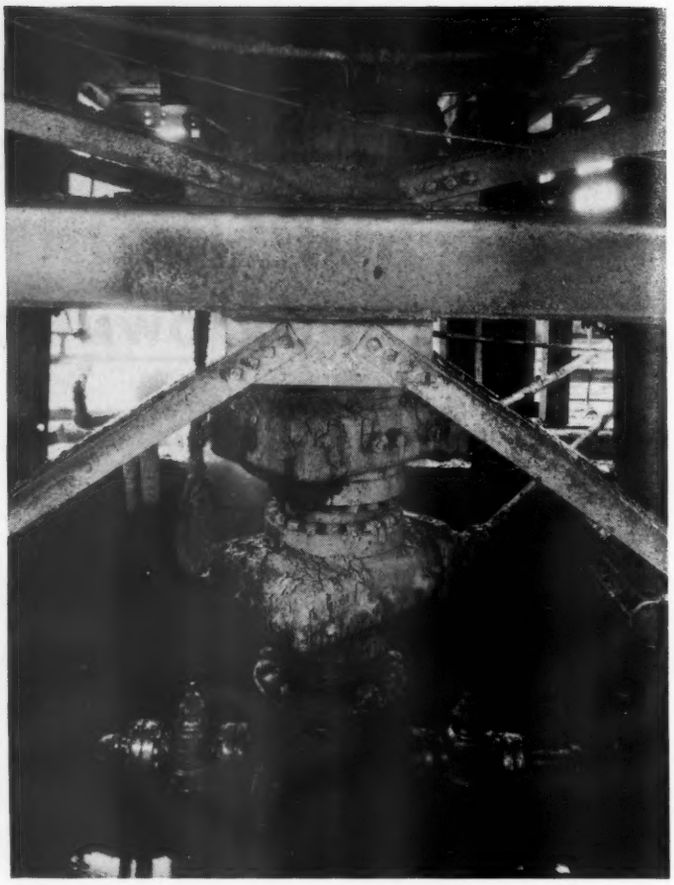
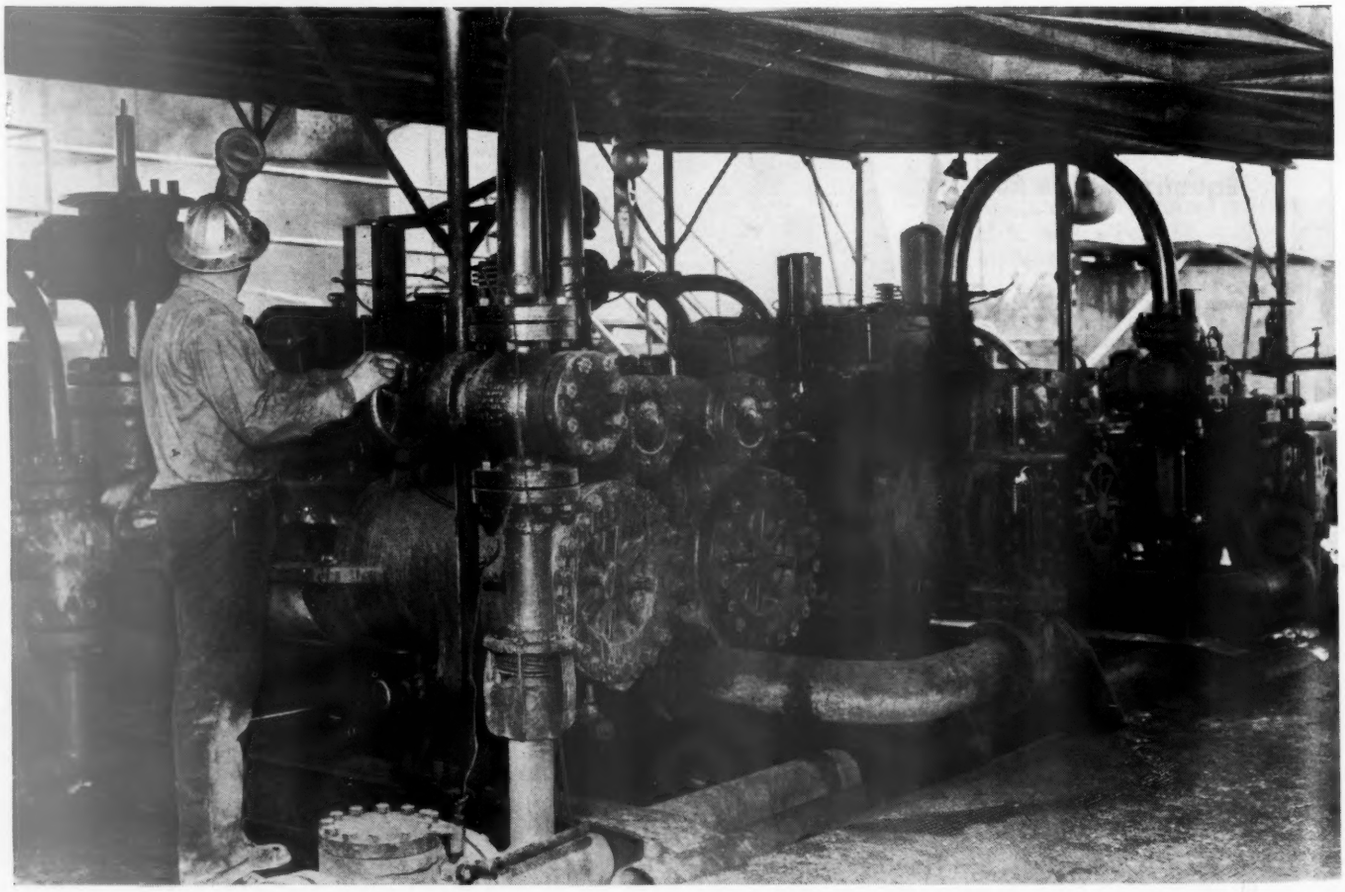


Battery of five all-welded boilers.



Blowout preventer equipment, 13⅝-in. diam.

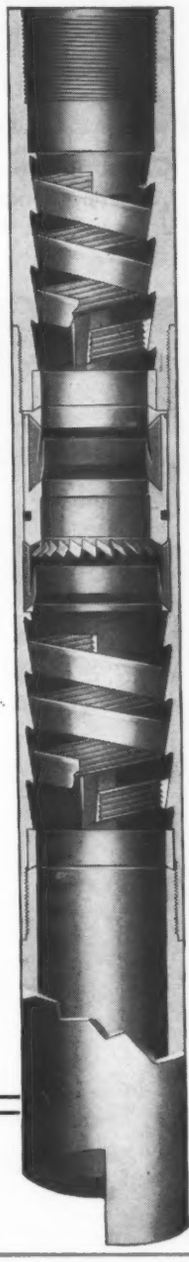
Steam end of pumphouse, showing two slush pump and one mud mixing pump.



Here's How To Be Ready For ANY Twist-Off Troubles!

One thing about today's overworked drill pipe — you can never be sure when—or where—it's going to twist off. It may be at a coupling, or tool joint (leaving a box or pin up) . . . or in the pipe body itself, leaving a jagged end to catch . . .

But you can be ready for an emergency of this sort if you have the Bowen Releasing Overshot on your rig! As normally furnished, it will catch tool joint, or coupling or pipe—whichever is up—without changing slips or making any adjustments. It has a special spiral gripping member called a grapple which, as soon as it is over the fish, takes hold with a rock-solid grip that only cinches tighter as pull increases. A bottom guide helps the tool over the fish, and a built-in milling member rounds up any ragged pipe ends. You get a full length grip on the fish that stands the hardest jarring strains — gets you out of trouble quicker.



SIMPLE OPERATION

Only the "grapple grip" of the Bowen Overshot gives you this positive operation: As the grapple moves down over the fish, the run-in string is rotated to the right—slowly. Then, twist is allowed to slack out of the string and the grapple instantly takes hold of the fish, ready for an upward pull. If necessary, release is a matter of a downward bump and a turn to the right coupled with simultaneous upward movement. It both sets and releases TO THE RIGHT—a vital safety point!

The Bowen Overshot is available with from one to four bowls to meet all conditions encountered—and in sizes for every pipe string. Sold outright for export.

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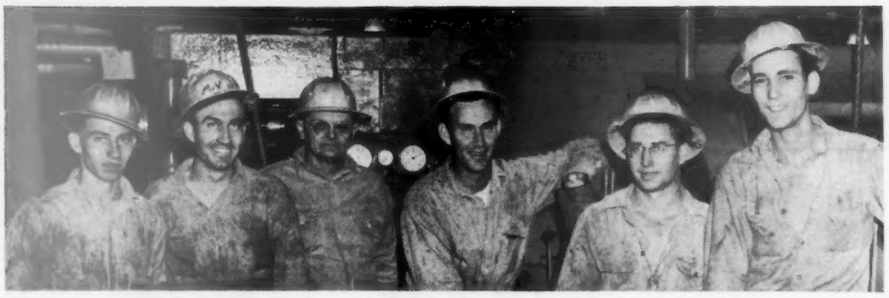
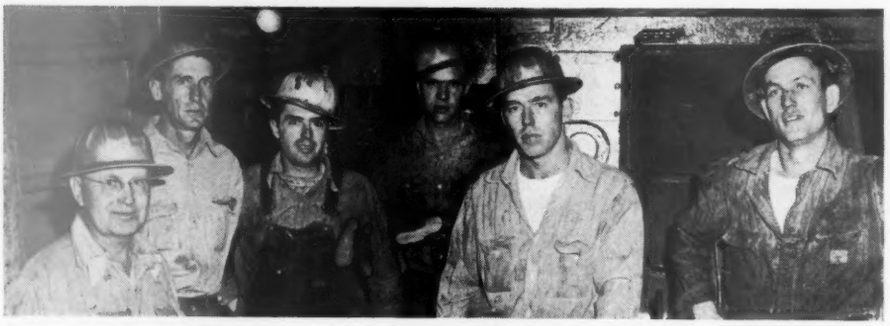


One of the crews. Left to right, J. M. Evans, floorman; A. J. Bateman, floorman; W. E. Blake, fireman; Carl Copeland, driller; W. L. Bowen, derrickman; C. L. Craw, floorman.



Another of the Limoneira crews. Left to right: E. A. Dowd, fireman; N. E. Horton, floorman; L. W. Harp, floorman; Dairl Campbell, floorman; C. H. Nelson, driller; Guy W. Stacy, derrickman.

the average rate was about 3 to 4 ft per hr. The deepest core—a 10-ft section between 18,428 and 18,438 ft—yielded a recovery of 7 ft of shale and sand, or 70 per cent in 5 hr.

Drilling Time

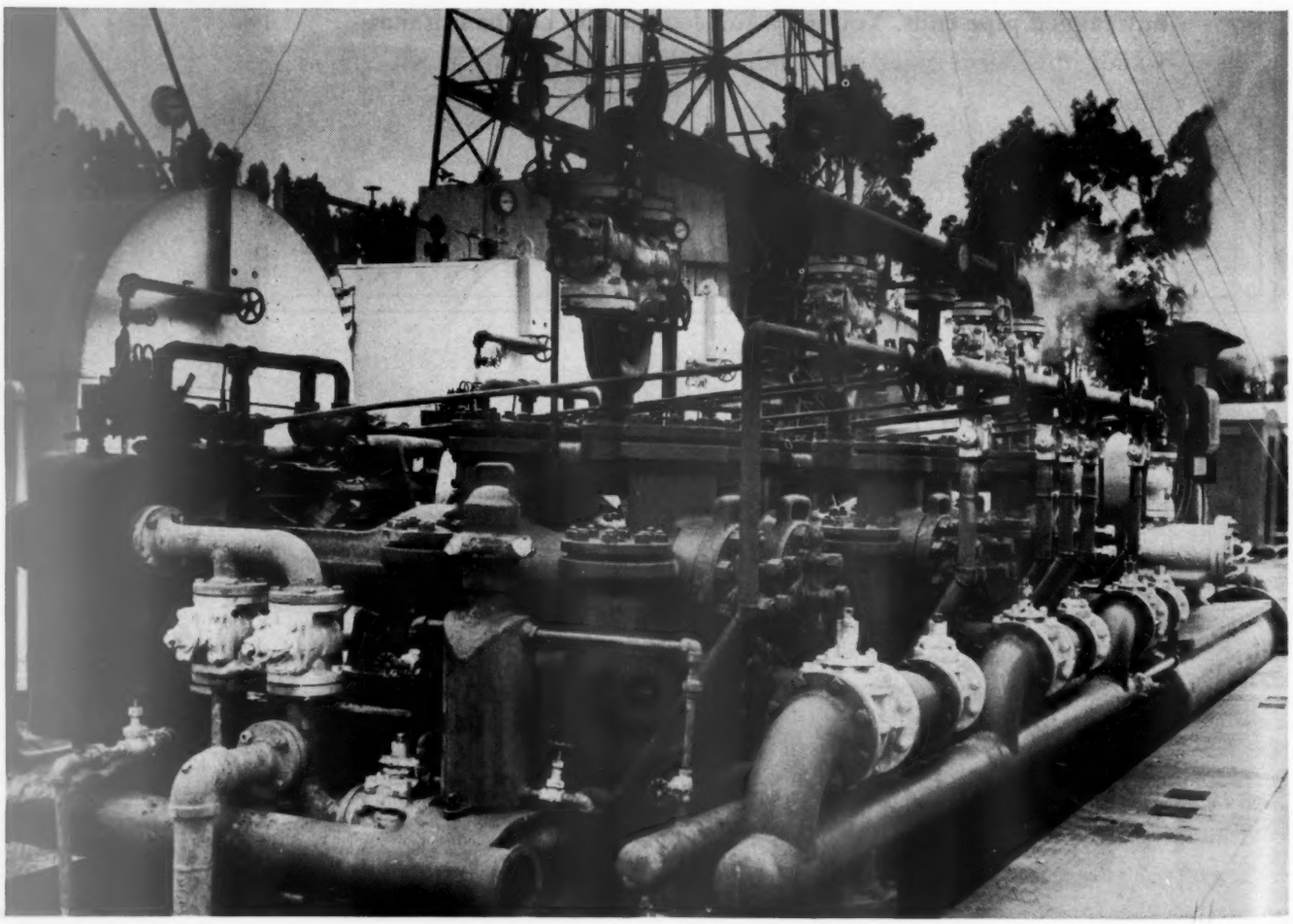
Actual drilling hours to 18,438 ft numbered 2052 for an average drilling rate of 8.83 per hr, and, to this point, the tools had made 185 round trips. At the maximum depth, a round trip took about 10½ hr. In drilling the 12¼-in. hole, 87 bits were used for an average of 115.5 ft per bit; the 8⅜-in. hole took 76 bits, for an average to 18,438 ft of 84.3 ft per bit.

Single shots were used to check deviation, and it was found that the maximum drift to 9000 ft was not more than 3 deg. From there down, it was held within 2 deg. The total accumulated drift was calculated to be about 385 ft, with the bottom of the hole not more than 200 ft off vertical.

Drill Pipe

The 17½-in. hole was drilled to 1979 ft with 5 9/16-in. 22-lb., Grade

Three 10-in. by 6¼-in. by 10-in. boiler feed pumps used on Superior's record deep well.



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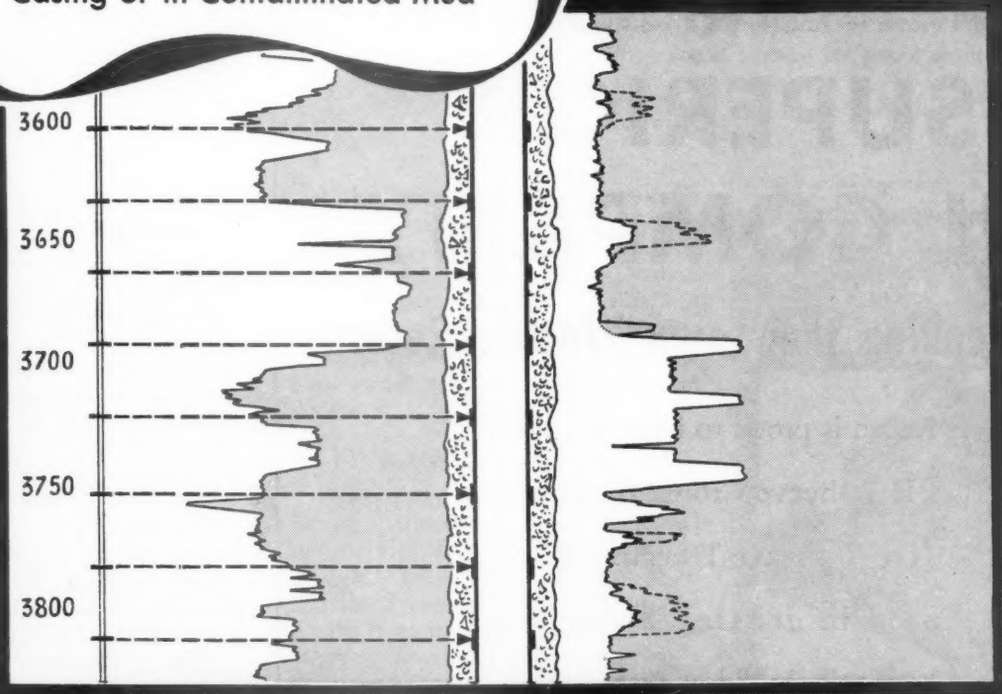

GAMMA RAY CURVE shows character and extent of all formations thru which the well passes!

COLLAR LOG at left ties formation to fixed, immovable reference points!

NEUTRON CURVE shows extent of all fluid in formations!

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Some of the men who made it possible. Left to right: Lew Rogers, petroleum engineer; Mel Uffen, drilling foreman; J. F. Gorman, fireman; S. H. Staley, floorman; K. L. Compton, relief driller; Bill Brown, driller; M. Harris, extra fireman; H. L. Huddleson, D. L. Walker, derrickman; C. M. Pace, floorman.

REGAN

extends congratulations

to

SUPERIOR OIL COMPANY

for breaking their own World's Record

Regan is proud to have had their EH 7-sheave Crown Block and 104" 6-sheave Traveling Block used in drilling Superior's Limoneira I wildcat near Ventura, California, to 18,734 feet.

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D, Range 3 drill pipe, with API full hole tool joints. From that depth 12¼-in. hole was drilled to 12,030 ft with 4½-in., 18.10-lb., Grade E, Range 3 drill pipe, equipped with 6½-in. OD tool joints.

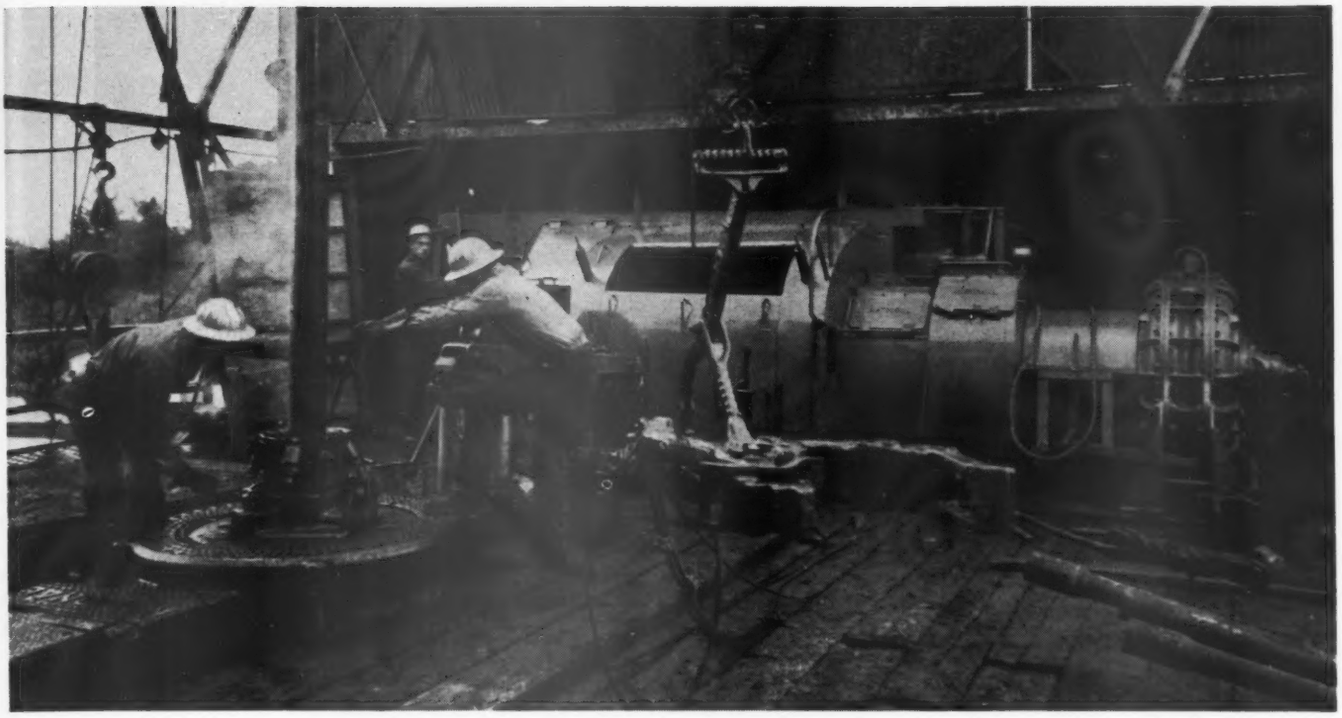
After 9⅝-in. casing was cemented at 11,204 ft, a new string of 4¼-in., 18.10-lb., Grade E, Range 2, drill pipe, equipped with 6⅛-in. OD tool joints, was used to drill 8⅜-in. hole from 12,030 to 17,400 ft. At this point, 12,200 ft of the afore mentioned 4½-in. drill pipe was retained in the string and enough 3½-in., 15.50-lb., Grade E, Range 3, drill pipe, equipped with IF flash welded tool joints, was added to reach bottom.

To 12,204 ft, about 300 ft of 7¾-in., 40-ft, drill collars were used. After drilling out of the 9⅝-in. shoe, about 250 ft of 6⅛-in., 40-ft, drill collars were used to 18,136 ft. At 18,136 ft, the drill collar size was reduced to 5¾-in., using about 240 ft of 5¾-in., 30-ft collars.

Drilling Mud

Throughout the drilling program, a lightweight—80 to 82 lb., 40 viscosity mud was used, and from the fact that all the trouble that developed was more or less minor in character, it may be assumed that the program was well devised. The mud was treated to assure the minimum water loss; to maintain stability and emulsification; and, finally to impart some lubricating quality. The success that was achieved in freeing stuck drill pipe, and restoring circulation on several occasions was an indication that the mud was about as near right as it is possible to get it.

An outstanding feature of this entire project is that it was drilled with a rig that has been in service for almost 9 years. As its design was probably contrived several years before that, we have every reason to believe that the engineers of the petroleum industry and the manufacturers of pe-



Floor of the derrick showing the main drawworks, with hydromatic brake and break-out cathead; also the rotary table and kelly. The entire rig has been in service for about eight years.

troleum equipment, have the future of drilling well protected. Here we have a 9 year old outfit drilling, with little or no trouble, a hole 18,734 ft deep, while lots of the skeptics are still debating whether or not we can drill to 20,000 ft.

Wyoming May Get Title

It would seem from the result of this project that but little adjustment is needed to close up the small gap that remains between depths that have already been reached and 20,000 ft. Incidentally, it is possible that before this article goes to press 18,734 ft will no longer be a record depth. It is reported that another Superior venture in Wyoming, has already passed the 18,000-ft mark and is still drilling ahead.

Derrick and Blocks

The equipment used on the Limoneira well, although by no means new, was apparently quite capable of carrying out the rugged job to which it had been assigned. It consisted of a 176 ft by 32 ft base derrick, with an 11-ft substructure, and a capacity of 980,000 lb. It was equipped with a 7-sheave, 600-ton crown block, and a 104-in. traveling block, both grooved for a 1¼-in. wire line. With respect to the wire line, the figures released show for one 10-day period, a total of 9252 ton miles at a cost of 20 cents a ton mile.

Some idea of the wire line work loads may be gleaned from the fact that between 17,062 and 17,992 ft, fifteen round trips were necessary. At that time the average daily footage was about 30, so we may conclude that the interval represents some 23 days of drilling time. Thus, we have 15 roundtrips taking place in 23 days, or, to put it in another way: as it took about 10 hr to make the round trip at that depth, we have 150 hr of wire line travel in 23 days under the most strenuous conditions — carrying not less than a 300,000-lb load.

Hoisting Equipment

Heavy duty elevators, and hydraulically operated power slips were used on the rig. The rotary table was a 20½-in. table, shaft driven from standby drawworks, and at the lowest depths it maintained a speed of 70 to 80 rpm. The main drawworks was a three-shaft, three-speed, steam engine driven unit, with low and high drum drives employing double-double 3⅛-in. chain. (Each drive consisted of two 3⅛-in. double width chains).

The high drum clutch was a double-plate 36-in. friction air clutch; and the low drum clutch was of the jaw type. The spool, 32 in. by 57 in. was grooved for 1¼-in. line. Brake rims were 62 in. by 10 in.; the drum shaft 11¾ in.; and the jack shaft 11 in. in diam. A double 40-in. hydraulic brake, and an air operated cathead were employed. The drilling engine was a twin 15-in. by 16-in., 500-psi, all steel unit.

In addition to the above, the stand-

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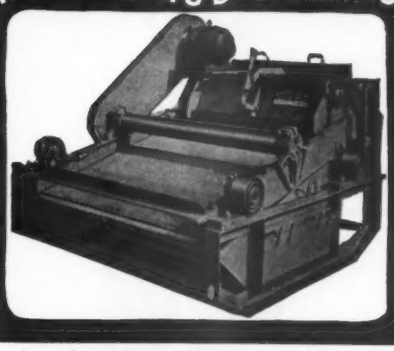

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Cameron Shear-Relief Valves protect pumps, manifolds, drilling hose, etc., against excessive pressures by releasing the flow of fluid through the valve outlet. A common nail shears when pump pressure against the valve piston reaches the shear stress of the nail.

The sheared nail is the only damaged part, and the valve is easily reset with another nail by any member of the crew, using directions on the valve nameplate for nail sizes and the pressure at which each size shears.

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Some of the men who helped drill the world's deepest well. Left to right: B. S. Parris, driller; A. J. MacDonald, floorman; C. F. Staley, floorman; H. L. Stepp, derrickman; C. Davis, floorman.

by drawworks and rotary drive, with sand reel powered by a 12-in. by 12-in. steam engine, had the throttle and reverse remote-controlled hydraulically, so that they could be applied from the normal operating position. The main pumps were two 15½-in. by 9¼-in. by 22-in. duplex, with a 14½-in. by 7½-in. by 18-in. being used in the mud mixing process.

Operations at 18,000 Ft

At 18,000 ft, a check showed 7¾-in. liners in the 22-in. pumps, then operating at 18 to 19 spm with 1600 to 1800 psi pressure. The pumps were not being compounded at that time—one was being used for drilling, and the mud weight was being held close to 82 lb per cu ft. The weight indicator showed 312,000 lb when drilling with an increase to about 330,000 lb when it was being picked off bottom. Ten lines were strung up, and the rotational speed was 70 to 80 rpm. At this time the hole was free and in excellent condition. The practice was to pick up about 60 ft and circulate a little every 15 min.

Five 130-hp 500-psi boilers were used to supply steam; three 10-in. by 6¼-in. by 10-in. pumps handled the feed water, which was treated in advance in a battery of four water softeners. Electricity was provided by two 15-kw, a-c generators, driven by steam turbines.

It seems unnecessary to go on describing the equipment that was employed in this project, because, actually, the success story lies not in new ideas and new equipment, but in the

K. L. Compton, driller, at controls on record deep well.

TIGER BRAND WIRE LINE on a deep well in Texas. By keeping an accurate check on wear, the line was shifted at the right time to avoid excess wear at any particular spot. The result was greatly increased life.

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How about your wire lines? Are you getting the maximum service life that is built into them? Sometimes a slight change in your plan of operation and maintenance may give you greatly increased service and a sizeable reduction in wire line costs.

Our booklet, American Tiger Brand Wire Lines for Oil, Gas, and Water Wells, shows many ways to save money through proper care of wire lines. Write for a copy today.

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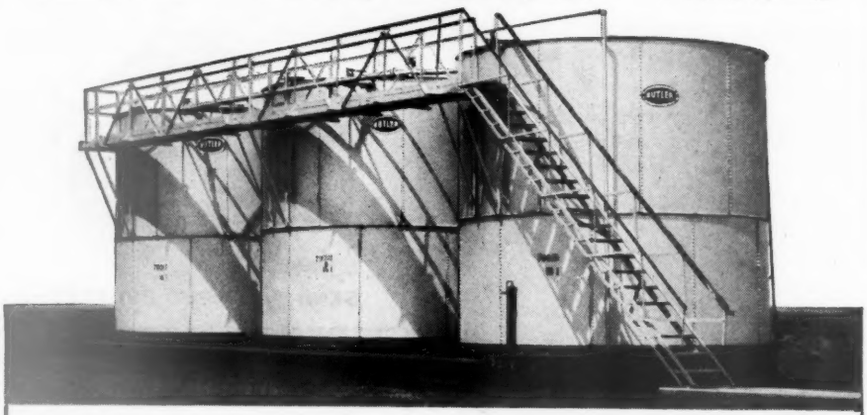

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efficacy of already established techniques, machines, supplies, and services. About the only new device that was used on the whole job was the safety joint, mention of which has been made in an earlier paragraph. This was placed in the string after the hole had passed the 9000-ft mark, and it proved to be a very worthwhile protective device.

Regular Equipment Used

So also it may be said of the mud screens, tankage, and other equipment; the cementing devices and technique; the instruments for locating the frozen point of the stuck pipe, and the jars for loosening the pipe; the pipe protectors; the rotary hose; crown block, traveling block, swivels, links, etc. All of them proved entirely capable of tasks "beyond the ordinary call of duty," and yet, as we have indicated, almost none of them were especially designed for this deep drilling job.

Some of the accessories, like fishing tools, blowout preventers, and the casinghead, never had a chance to prove themselves, but they were essential equipment nonetheless. The smoothness of operation that resulted in the establishment of a record depth with the minimum of trouble may partly, at least, be attributed to the use of simple, speedy, yet safe, power slips, tongs, elevators, and other tools, by men adept in their manipulation.

It was estimated that drilling was halted just above Miocene, but taking everything into consideration, Superior probably figured they had challenged their luck long enough, and the safe thing to do was to call a halt before it was called by some accidental circumstance.

From the beginning to the end, the Limoneira No. 1 was a carefully planned and conducted project. There seems little doubt that the Superior Oil Company is profiting greatly by its own experience. Besides drilling the Oklahoma world's record well, the Company also drilled a 15,727-ft well in Mississippi that still holds the record for the state, and, as we have already remarked, a Wyoming well is in progress that is already past the 18,000-ft level, and may be a new world champion before this article comes off the press.

Those operators who have attempted to drill the modren concept of a deep well will appreciate fully the careful planning, technical skill, and patience that is required to assure the successful drilling of a hole almost 19,000 ft deep. It means that everyone from the top executive, directing the proceedings, to the men on the rig who actually do the drilling, must have the

21st CONSECUTIVE WORLD RECORD WELL!

K. Compton, driller, shown watching the Martin-Decker Drilling Control Panel on Superior Oil Company of California, Limoneira No. 1 in North Montalvo area, Ventura County, California. (Depth 18,734 ft. March 13, 1949.)

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know-how to execute their respective duties cooperatively and well.

The Men Who Drill Deep

In this respect, credit goes to Superior Oil Company vice presidents, W. M. Keck, Jr., John C. Cody, and R. M. Allan Jr.; to drilling superintendent, Carl L. Corley; petroleum engineer, Lew Rogers; chief geologist, Jack Isberg; drilling foreman, Mel Uffen; district geologist, George Wheatley; mud engineer, Bud Jones; not to mention the members of the drilling crews.

These men combined executive, technical, and mechanical skill in a venture that was quite unproductive of crude oil, but certainly must have been productive of invaluable information. If nothing else, the project developed operational experience that should stand the Company in good stead as the limitation of unexplored territories forces the driller ever deeper in his quest for the pay fluid.

Benefits of Deep Drilling

Two further benefits to be derived are: (1), that existing equipment and tools have been tested almost, in some instances, to the limit of their capacity, and the actual requirements for still deeper drilling have thus been determined. (2), hitherto unreached depths have been probed and the pertinent subsurface forces and effects that obtain at these depths have been examined.

The Cost?

We have no knowledge of the ultimate cost of drilling Limoneira No. 1, but it was surely a sizable sum, and it seems to this writer that in the industry's public relations program here is one aspect that is soft pedalled too much. When it is all over, a project of this sort is something more than the mere drilling of a duster. It is in actuality a piece of important investigatory work that can readily be classified under the head of drilling research.

The progressive oil company doesn't expect to bring in a deep well like this—it hopes to, of course—but the drilling has to be done in either case by one company or another, sooner or later, in order to keep prevailing plants, processes, and practices from becoming sterilized by the pyramiding difficulties that progress itself imposes. So, the modern petroleum company makes due allowance in its planning for applied research of this kind. At the moment Superior Oil Company is in the van of the deep drilling race, and it appears that it might hold the lead for some time to come. * * *

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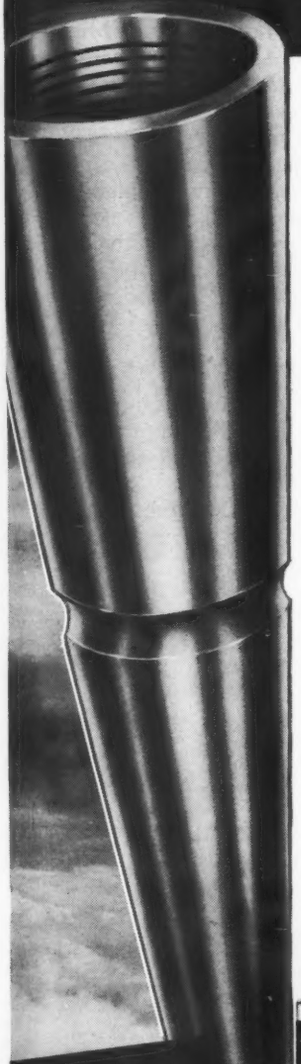

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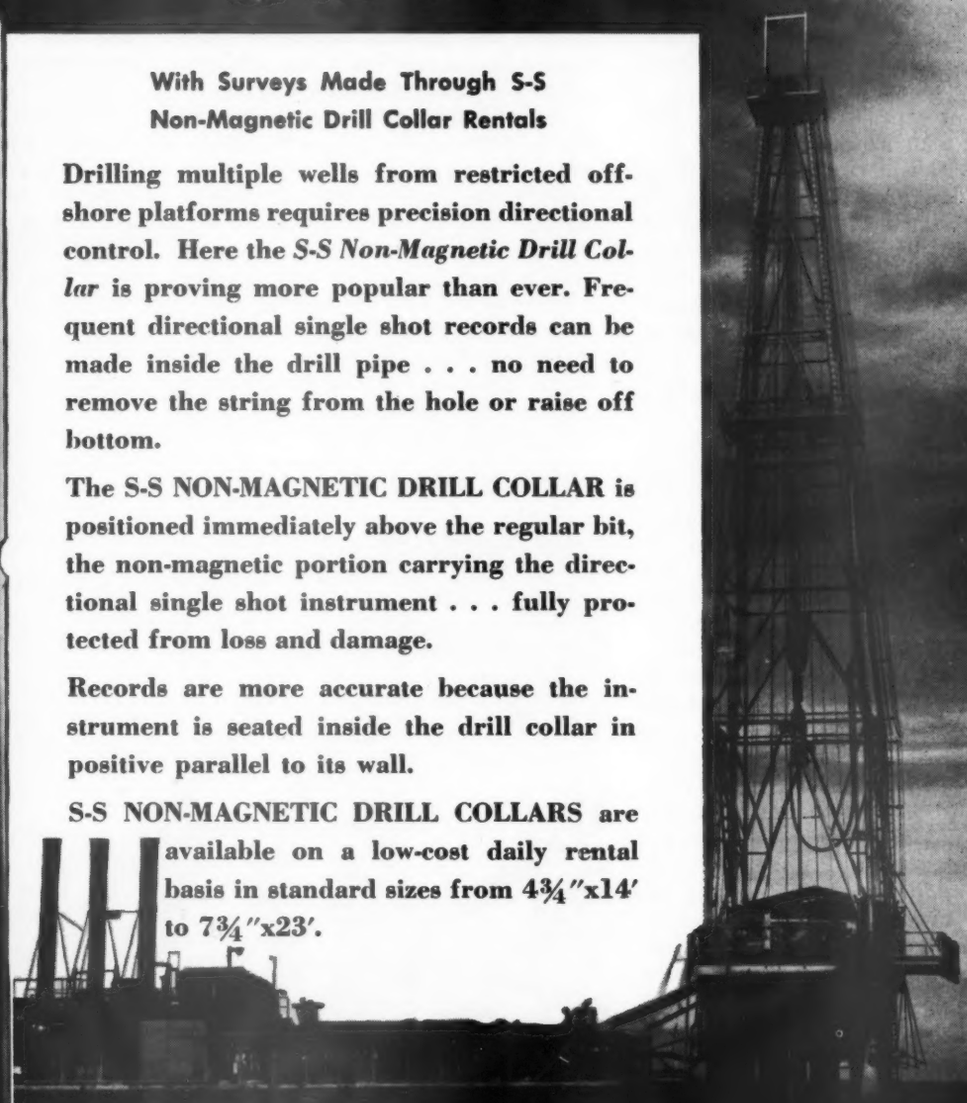

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Corrosion Problem in Offshore Drilling

ARTHUR E. BURNS, JR.*

THE corrosion problem on an offshore drilling structure is of critical importance and should be considered carefully to avoid premature deterioration of expensive equipment. The rapidity with which improperly protected steel will corrode under these severe marine conditions can hardly be appreciated until it is observed firsthand. In most instances the protective measures that have been adequate for use in land operations are not suitable under the much more severe conditions offshore.

Three Exposure Areas

Fundamentally, there are three distinct areas of exposure involved on an offshore structure. These are: (1) the continuously submerged area below the low tide level; (2) the intermittently submerged area between the low and high tide level; and (3) the area above the high tide level. Due to wave action, the boundaries between these areas are relatively narrow zones rather than sharp lines. Each of the areas presents distinctly different problems to the corrosion engineer and paint chemist. Paints or coatings suitable for use on one area are frequently entirely unsatisfactory for use on another area.

The conditions encountered on an offshore structure are quite comparable to those experienced on an ocean-going vessel where the underwater bottom area, variable draft area, and topside area are analogous to the three distinct exposure areas cited in the previous paragraph. Experience gained in the marine field thus is directly applicable in most instances to the offshore problem. In fact, it constitutes the primary source of data upon which a solution of the offshore corrosion problem can be based.

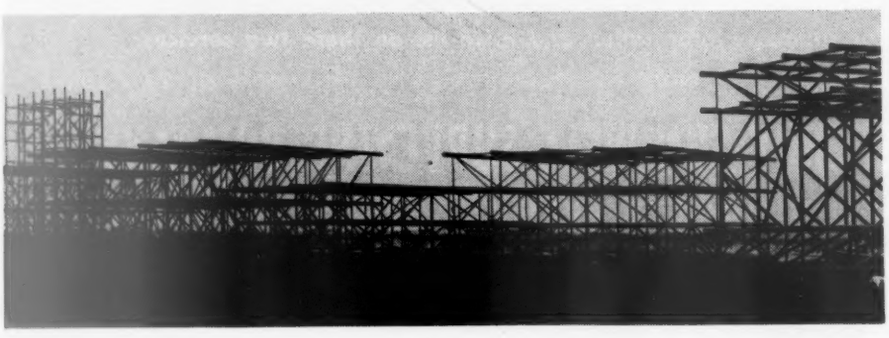
Paints and coatings commonly used for protection of steel under atmospheric exposure are entirely unsuitable for use on the continuously submerged area below the low tide level. As a general rule, the long oil type of vehicle having excellent resistance to ultraviolet light on atmospheric exposure is a very poor material for underwater use. These materials, which include red lead or zinc chromate primers, and the common drying oil or synthetic top coats, tend to soften badly and to fail rapidly by blistering and loss of adhesion on continuous immersion. A short oil or oil-free, high-resin vehicle should be used for underwater work, because this type of material retains its adhesion and has much less tendency to blister. The type of vehicle used is usually of greater importance than the specific pigmentation. No single type of pigmentation seems to be outstanding for underwater work.

Fouling Factor

A factor that always must be considered on the underwater area is the problem of marine fouling. The Gulf of Mexico is noted for its high rate of marine fouling. Any offshore structure

*Internationally known authority on paint chemistry, formerly consulting chemist with the U. S. Navy—now chief chemist with Hart and Burns, Inc., Riverside, California.

EXCLUSIVE



Painters in a gulf coast shipyard apply a protective coating with a power spray to the pre-fabricated structures that are to be used in offshore drilling platforms.

Left, pre-fabricated drilling platform structures in a gulf coast shipyard that have been treated with two coats of brine resistant primer and two coats of plastic antifouling paint.

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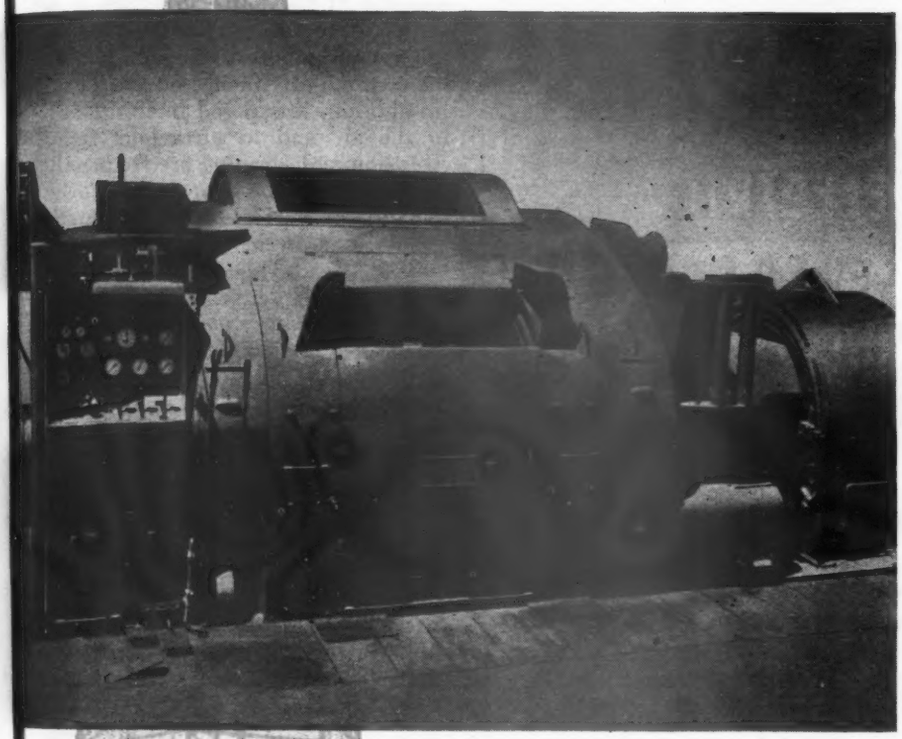
The No. 96 Rig is your logical choice for deep well off-shore drilling because . . .



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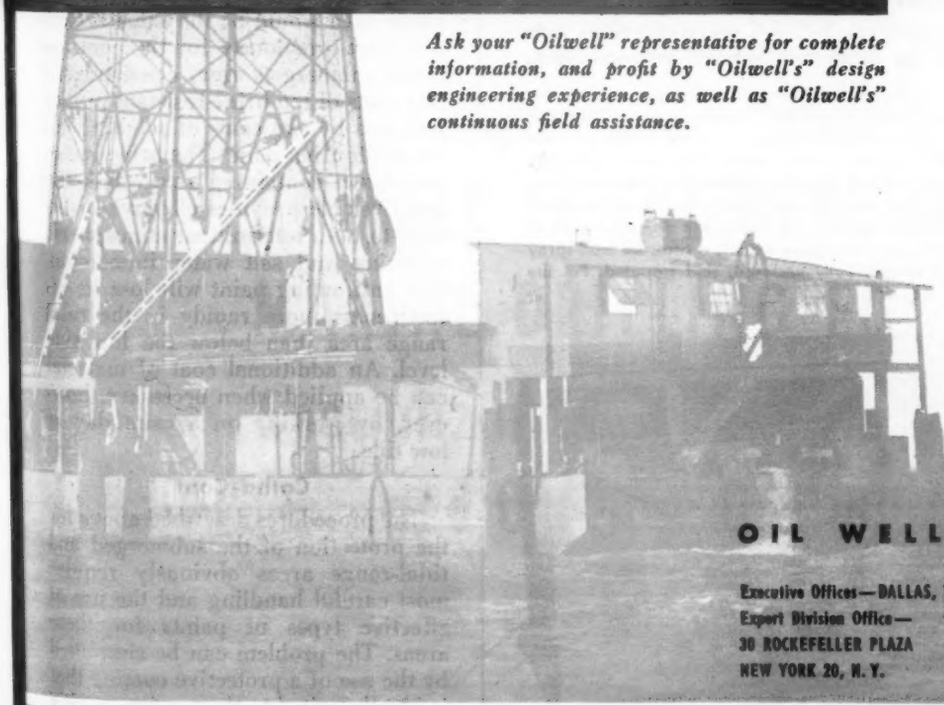

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in this area can be expected to foul rapidly with barnacles unless it is protected with an effective antifouling paint. Once barnacles attach to a surface, they will rapidly cut through and destroy the effectiveness of any organic paint film. As an example, on net buoys it was found that barnacles would cut completely through a quarter-inch film of hot mop coal tar enamel within a few months. This type of film failure seems to result in the development of a serious pitting type of corrosion.

A painting procedure that has been used on the continuously submerged area of several offshore structures is as follows: (1) Clean the surface mechanically by wire brushing or by the use of pipe cleaning machines. (2) Apply one coat of red brine-resistant underwater primer immediately after cleaning, and preferably before the structure is fabricated. (3) After fabrication of the structure, all welds should be cleaned of flux and spot-primed by brush, and all scraped areas should be spot-primed at the same time to obtain an intact prime coat over the entire area. (4) A second coat of brine-resistant underwater primer should then be applied. (5) Apply a coat of soluble matrix antifouling paint. 6) Follow this by a second coat of antifouling paint not more than a week before the structure is to be erected. The dry film thickness of the two coats of brine-resistant primer should be not less than 4 mils (.004 in.), and the dry film thickness of the two coats of antifouling paint should be not less than 7 mils.

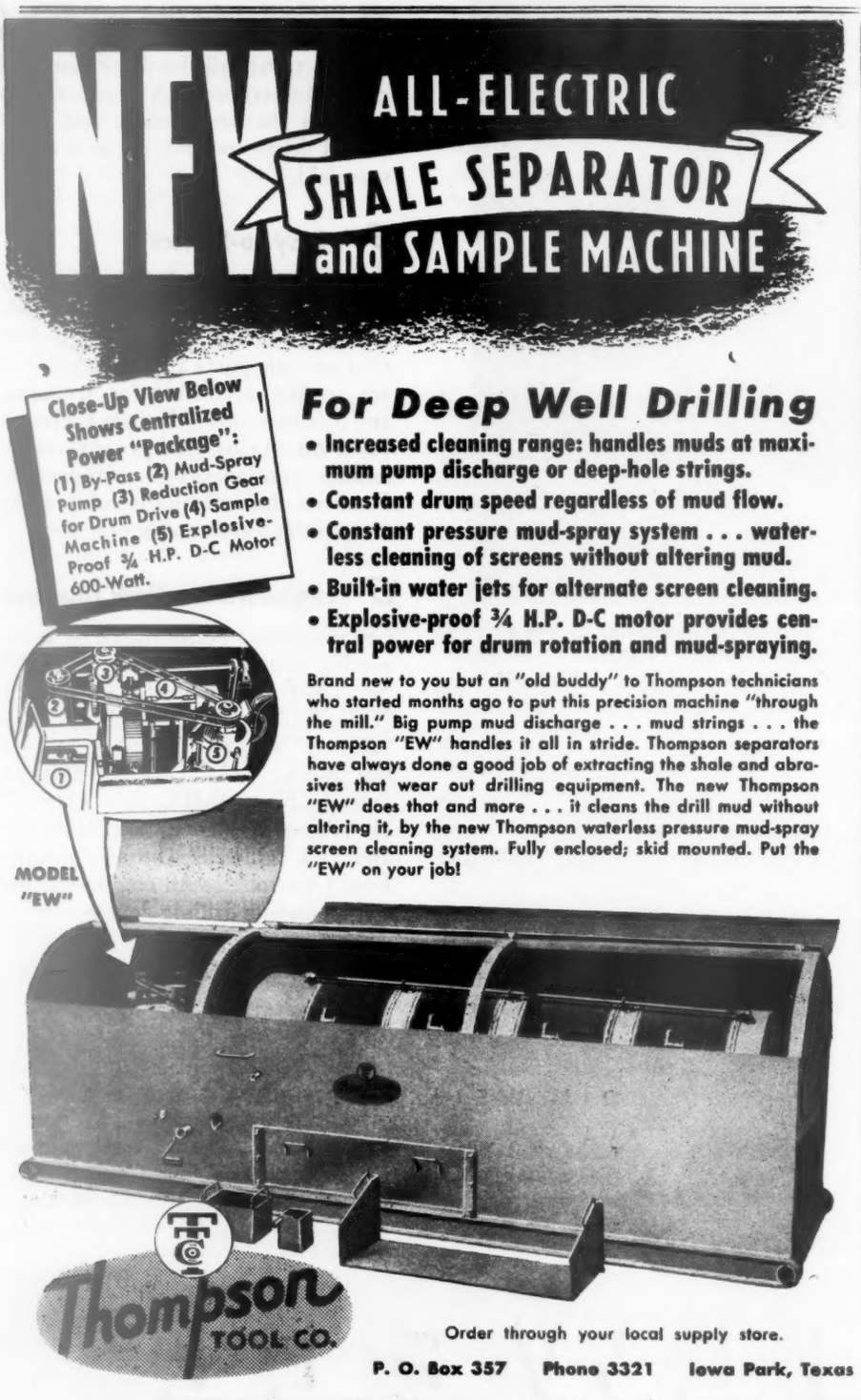
The intermittently submerged area between the high and low tide level presents the most severe corrosion problem of the entire structure. It is subjected to the same conditions of salt water immersion and fouling as the continuously immersed area, and, in addition, is exposed intermittently to the air and to ultraviolet light. Abrasion and scraping are frequently a problem and the temperature variation on the surface is always much greater than on the continuously submerged area. This tidal-range area does have the advantage, however, that maintenance painting can be done, when necessary, at low tide.

Paints designed for use under water are usually affected adversely by intermittent drying, by ultraviolet light, and by wide temperature variations. Paints designed for use above the waterline usually show even worse failure in the tidal-range area, however, due to blistering, softening, and marine fouling. For this reason it is generally better to use underwater paints in this tidal-range area rather than topside coatings.

A practical procedure for the tidal-range area would be the same system described previously for the continuously submerged area, consisting of two coats of red brine-resistant primer followed by two coats of soluble matrix antifouling paint. The brine-resistant primer containing a pure Bakelite resin vehicle provides effective resistance to both intermittent atmospheric exposure and salt water immersion. The antifouling paint will lose its effectiveness more rapidy in the tidal range area than below the low tide level. An additional coat of material can be applied when necessary, however, by working on a calm day at low tide.

Catha-Coat

The procedures described above for the protection of the submerged and tidal-range areas obviously require most careful handling and the use of effective types of paints for these areas. The problem can be simplified by the use of a protective coating that is ideally suited to the service. Such a coating is Catha-Coat, a completely inorganic composition containing an extremely high percentage of metallic zinc. Catha-Coat forms a very hard,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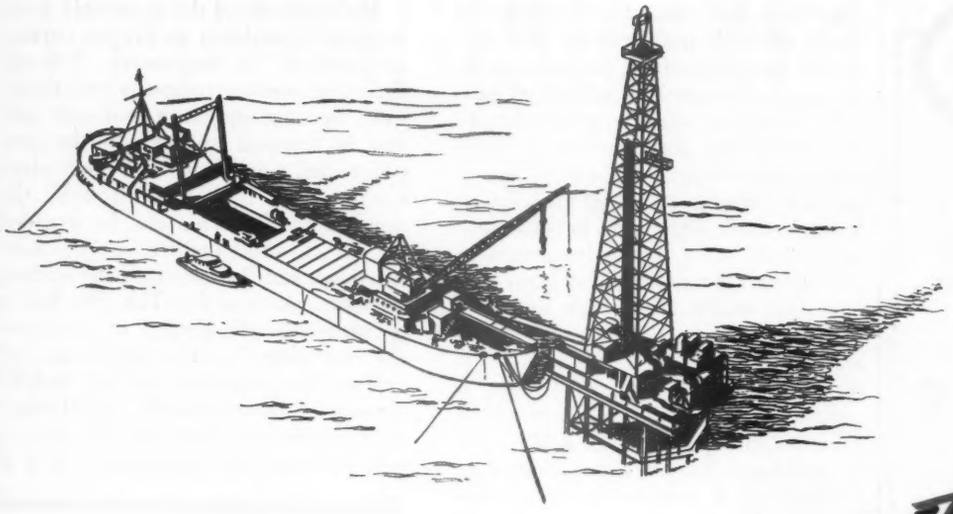

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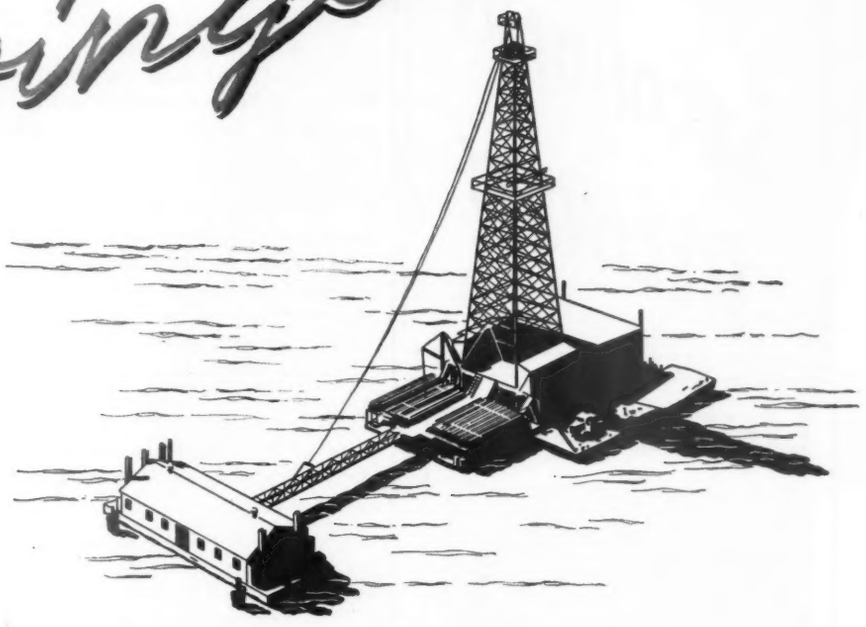

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gray film that consists essentially of finely divided, pure metalic zinc dispersed in and partially combined with an inorganic matrix. Catha-Coat provides effective cathodic protection to the underlying steel due to its high zinc content. Corrosion cannot creep under the film or attack at pinholes or imperfections in the film, as is the case with some other paints immersed in salt water. Catha-Coat is so hard that barnacles will not penetrate the film; and, for this reason, the need for an antifouling paint is eliminated. At its recommended coverage of 150 sq ft per gal the applied film contains about 2.7 oz of zinc per sq ft. In addition to its resistance to salt water corrosion, Catha-Coat is completely unaffected by exposure to gasoline, crude oil, and organic solvents that rapidly soften or disintegrate some paints.

Catha-Coat has been used effectively as a protective coating on the submerged and tidal-range area of offshore drilling structures in the Gulf area and has been used to obtain highly satisfactory protection in a number of other similar applications on marine equipment, salt water ballasted tanks, and industrial equipment.

Although the area above the high tide level presents a serious corrosion problem, it can be protected with marine topside paints. The most important consideration is to provide adequate film thickness for the combined primer-topcoat system. A minimum of four coats is recommended with a dry film thickness of at least 5 mils (.005 in.).

A practical specification would be two coats of marine topside chromate primer followed by two coats of gray marine hull-and-topside enamel. For this type of exposure, paint performance is not directly proportional to paint film thickness but instead, improves more nearly in proportion to the square of the film thickness. Thus, a four coat system could be expected to have roughly four times the durability of a two coat system. Present U. S. Navy topside painting specifications call for a minimum four coat system of the type recommended previously.

Deck surfaces should be protected by marine type primers and deck paints. Here again, a four coat system should be used for best results. A recommended specification would be two coats of marine chromate primer followed by two coats of non-skid deck paint. Non-skid deck paint contains 100 mesh pumice and gives a skid-resistant film having excellent abrasion resistance. Interior deck house areas may be protected with marine primers and cabin paints.

Maintenance of the accessible areas remains a problem as proper surface preparation is extremely difficult. Painting over corrosion is unsatisfactory, because moisture and salt residue is trapped underneath the new paint film. Corrosion soon takes place causing rust to "burn through" the new paint film. This can be avoided by either sandblasting, or by wire brushing and the use of a pre-painting treatment such as Pre-Tek. Pre-Tek is a composition designed to penetrate the rust scale, bond to the metal, and replace the moisture and salt residue present in the rust scale. Application of primers and topcoats are recommended after this treatment. * * *

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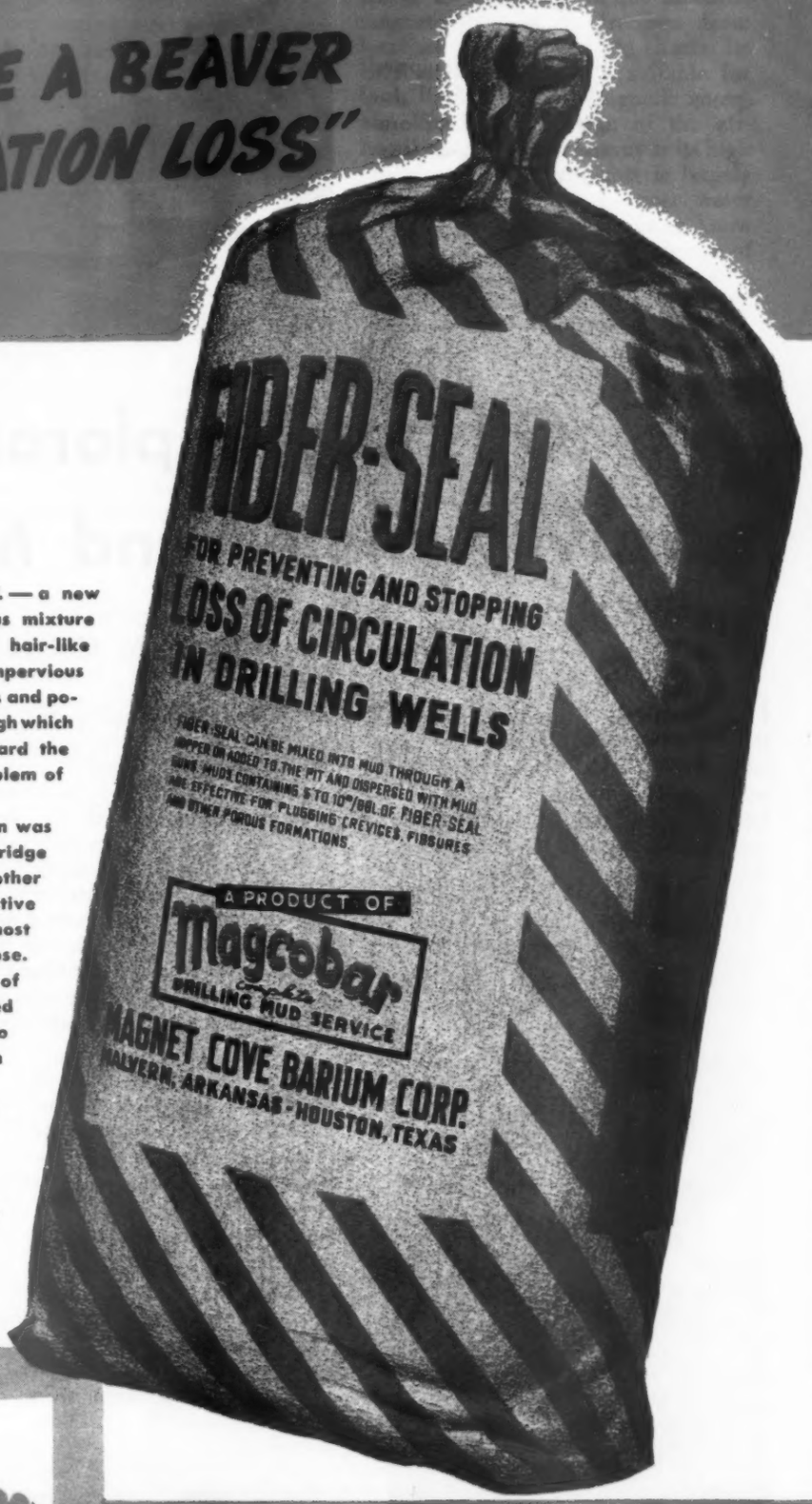
Keep 20 sacks on hand at the rig. It is cheap insurance against loss of rig time and expensive mud!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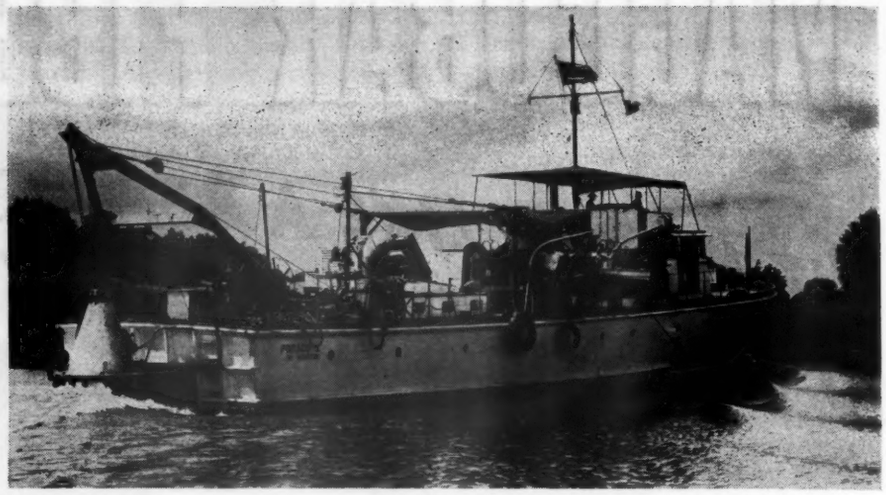


The *Poraco V* equipped with diving bell for gravity meter exploration in the Gulf of Mexico. The diving bell attached to the stern of the boat weighs about 4000 lb. It has been operated in water as deep as 250 ft.

Offshore Exploration With Gravity Meter and Magnetometer

EUGENE W. FROWE*

IN the relatively short period of time that geophysical exploration has been used, tremendous strides have been made until geophysics today is a highly developed art. The gravity meter and magnetometer have been developed into instruments of high resolution, and a great deal of information can be obtained about subsurface formations through their use.

Exploration work was first carried out in land areas, and, quite logically, it was extended to the marshes, and finally to water covered areas. The problems of working in marshes were rapidly overcome with the development of marsh buggies and, more recently, techniques for using helicopters. Most of the problems of working in water covered areas have now been solved. At first this work was limited to shallow areas, particularly bays and rivers, but it is now moving toward the deeper areas in the Gulf.

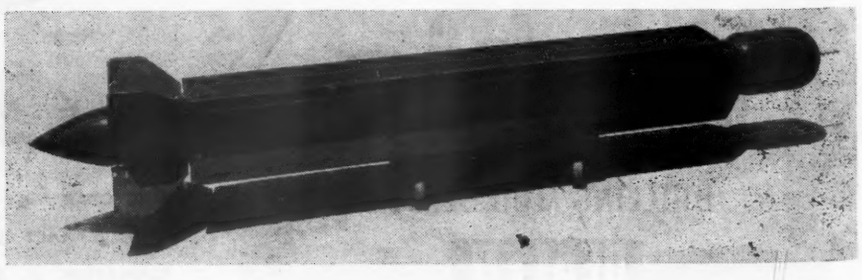
*Robert H. Ray Co., Houston, Texas.

Looking toward the stern of the Poraco VII, sister ship of the *Poraco V*, showing part of the installation of the new type remote reading gravity meter. The gravity meter housing shown in this figure weighs 500 lb.

Offshore Problems

Operating a gravity meter crew in the Gulf of Mexico presents several problems. First, the boat to be used must be large enough to handle the equipment and provide adequate comfort and safety for the crew. This means that a 60-ft boat is about the minimum size. The demand for boats of this class was met satisfactorily with war surplus vessels of the air rescue and patrol classes which were available at reasonable prices after the war.

A second problem is surveying. In gravity meter exploration it is necessary that the position of the gravity station be known to an accuracy of 200 ft. In inland waters and near the coast this accuracy is not difficult to attain with sextants, transits, and suitable communication equipment, but in the Gulf at distances greater than six miles from the shore surveying becomes a problem. Here again war surplus equipment has come to the geophysicists' aid with radar and Shoran,



This torpedo-like housing adapts the magnetic detector of the airborne magnetometer for water work.

both of which are accurate and effective at 15 miles or more. Radar is considerably cheaper than Shoran but, in general, is not as accurate.

A third problem is the gravity meter technique itself. Attempts were made originally to use the gravity meter on a tripod resting on the Gulf floor. This did not prove effective because wave and tide action made the readings unreliable. As early as 1938, efforts were made to develop a remote reading gravity meter, but these efforts were not very effective and further development was halted by the war.

The Diving Bell

Oil shortages during the war stimulated research on geophysical equipment, and several good underwater gravity meter techniques have resulted. A relatively simple solution was arrived at with the development of the diving bell, which permitted the gravity meter and an observer to be lowered in a water tight housing to the Gulf floor where direct gravity observations could be made. This technique is direct and simple. A standard gravity meter can be used without any modifications. It is necessary only to have a sufficiently large and rugged water tight housing for the man and the meter. This type of equipment has been used effectively for about five years.

Recently, however, remote type gravity meters have been developed that have proved very effective. These meters are enclosed in small water tight housings and are read remotely by an observer on the deck of the ship. Chief among the meter's advantages is its small size, which means the equipment can be operated with lightweight winch equipment. The remote gravity meter weighs only 500 lb as compared with the 4000-lb diving bell.

Greater speed of operation is another advantage, and the light weight makes it adaptable to operation in shallow lakes and bays from small boats. As the remote meter is read electronically, it is possible to use electronic integrator circuits on the reading mechanism, which improve the accuracy and ease of reading. The soft mud on much of the Gulf floor is continuously in motion. This motion disturbs the stability of modern high sensitivity gravity meters.

Airborne Magnetometer

The airborne magnetometer received a boost during the war when considerable developmental work was done to improve its accuracy and dependability. With the airborne magnetometer, it is possible to make accurate surveys of any area, water covered or otherwise, with a speed heretofore unknown. In addition to its speed, an advantage of the airborne magnetometer is its freedom from localized surface magnetic effects. Its high accuracy makes it suitable for locating the smallest magnetic anomaly. Chief disadvantage of the airborne magnetometer survey is its high cost for small areas. This is largely because, at high speeds over water covered areas, it is difficult to know position accurately without the use of Shoran or similar surveying technique. For large surveys the airborne magnetometer is economically sound.

In water covered areas it has been found practical to transport the magnetometer equipment by boat, pulling the magnetically sensitive detector on a long cable behind the boat to minimize the boat's magnetic effects. This method has proved very effective in working small areas economically, and, because of its relatively slow speed of operation, ordinary navigation aids such as the sextant and radar have proved very effective.

Clarification of the political control of the tideland areas should stimulate geophysical operations in the Gulf. A great deal more geophysical work remains to be done. * * *

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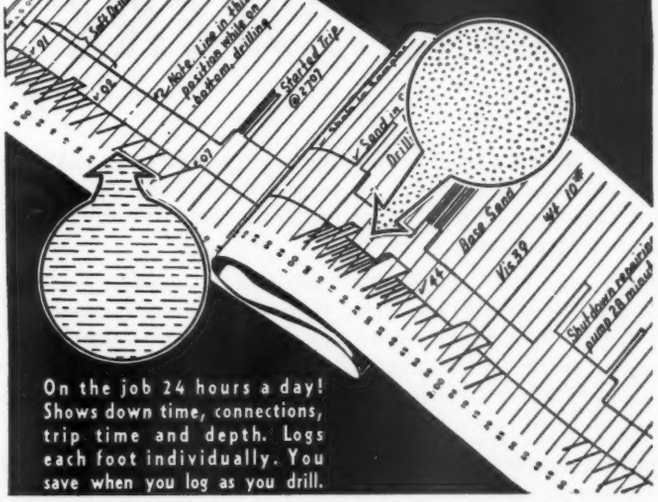

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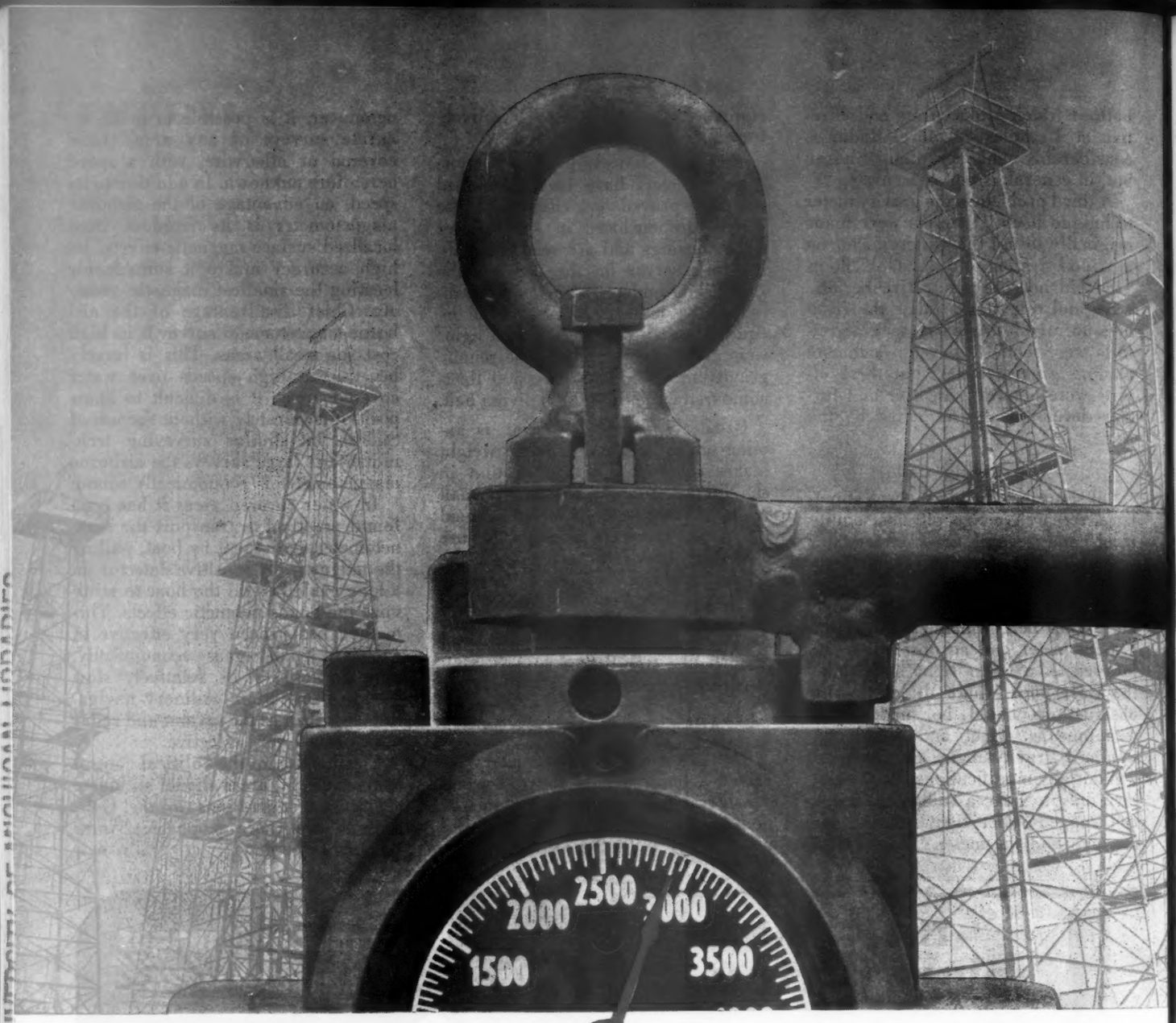

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THESE ARE THE DAYS OF FREE PUMPING

The Coast Guard Looks at Offshore Petroleum Developments*

J. A. KERRINS†

I ASSUMED, when you selected the subject, "The Coast Guard Looks at Offshore Petroleum Developments," that you wanted the look as seen through marine binoculars. This type is often fitted at the eye end with different colored glasses which may be used, when needed, to protect the eyes from the glare of the sun. Even though conditions at the present time are not bright enough to require their use, you may prefer that I insert the rose-colored glasses anyway.

Rights to Use of Navigable Waters

Until recently, drilling in this section of the country was confined to operations on land, or on inshore waters. With the demand for greater production of oil required for our economy, and for our national security, you undertook the responsibility of probing for new sources of supply beneath the waters of the Gulf. At tremendous expense, time, and effort, new fields have been located and drilling operations have been conducted with some results obtained thereby.

I have heard it said that these offshore drilling operations are entirely new. But, just what is new about them? It is true that insofar as the actual drilling is involved, you were faced with new problems which required the development of new techniques, but essentially, drilling is conducted much the same as it is on shore. To you as producers, the marine transportation, involving movement on sea of personnel and material, and the operation of vessels, is new.

But is there anything novel about shipping? Records left by the Egyptians indicate that, long before Cleopatra's barge, they were not unfamiliar with shipping.

I stated that I would look at the offshore developments through marine glasses. In looking, it can be seen that drilling and producing offshore affect interests other than those affected by your land operations. Placement of rigs and production of oil can seriously affect those engaged in their centuries-old pursuits of shipping and fishing on the sea.

The right of navigation has long been recognized as the dominant right in navigable waters, and is superior to the right of fishing and to the other rights. In the exercise of its power over navigable waters, Congress has authority to prohibit the creation of any obstruction in such waters, and also to determine what shall constitute an obstruction to navigation. While the right of navigation is the dominant right, Congress recognizes the rights of others to use the waters for other purposes. However, the rights of navigation on the navigable waters are zealously guarded, which explains why the erection of bridges, the construction of dams, and the diversion of navigable waters can be done only after authorization of the Federal Government.

Federal statutes make it unlawful to construct obstructions in navigable waters, unless the work has been authorized by the Secretary of the Army. Even when authorized, one who maintains an obstruction is under a duty to give suitable warning of its presence and location by lights and other signals, and is liable for injuries to navigators caused by a failure to perform such duty. This explains why it is necessary before construction is begun on a rig, that a permit be obtained from the District Engineer, Corps of Engineers, U. S. Army, and why, after it has assumed the proportion of an obstruction, it must be equipped with lights and a fog signal as a warning to shipping.

Growth of Marine Regulation

In moving seaward, you have entered a field, shipping, which has been regulated continuously for thousands of years. On the other hand, you, as producers, have been regulated for less than a century. Bearing in mind this entry into a well-regulated field, I wish to show how legislation affecting shipping was developed in order that the lessons to be learned from such a study may be applied so that the foreseeable effects of your operations upon others may be kept to a minimum, thus avoiding the necessity for corrective legislation and regulation.

For our purpose, we need to go back only to 1807, the year the first steamboat made a successful trial run. Having proved to be other than a folly, the use of steamboats rapidly developed. Coincident with their development, there was a corresponding increase in the number of marine casualties. Boiler explosions occurred at too frequent intervals. In 1832, 14 per cent of the steam vessels in operation were destroyed by explosions and fires which were responsible for the loss of more than 1,000 lives. This could not go on; and, as you can well imagine, the result was the passage of legislation for the better protection of the lives of passengers on board steamboats.

Thus it was that in 1838, the Steamboat Inspection Service was established, to provide inspectors of hulls and boilers for the purpose of ascertaining the seaworthiness of vessels and the proper construction of boilers. This statute did not legislate boiler explosions out of existence. They continued to occur. But so did the legislation and the regulations, until today the explosion of a marine boiler is a rarity. Gradual development of legislation brought about by other types of casualties led to the present-day requirements of inspection and certification of vessels, and the licensing and certificating of the personnel who man them.

In the summer of 1904, the excursion steamer *General Slocum*, with 1350 passengers on board, mostly women and children, caught on fire. Efforts to extinguish it were unavail-

*Presented before Spring Meeting of the Southwestern District, American Petroleum Institute Division of Production, Galveston, Texas, March 9-11, 1949.

†Captain, United States Coast Guard, and Secretary, Merchant Marine Council, Washington, D. C.

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Stanolind well off coast of Cameron Parish, Louisiana. Barge and crew boats are moored to platform.

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ing. Fire raged through the wooden hull of the vessel, weakening the deck supports so that when the vessel was beached, the decks collapsed, throwing the passengers into the flames and the water. Nine hundred and fifty-seven persons lost their lives on that day.

The shock of this tragic loss was so great that President Roosevelt was compelled to appoint a commission to investigate the causes, and to make recommendations for future action. The result was the adoption of legislation and regulations prescribing the measures to guard against and extinguish fires, and the number and character of lifesaving apparatus to be carried on board.

On her maiden voyage in 1912, the *Titanic*, the super liner of her day, with 2340 passengers on board, collided with a huge iceberg. Within three hours, she had gone to the bottom; and to their deaths went 1503 persons. All might have been saved if there had been an adequate number of lifeboats; but there was only a number sufficient to accommodate about 1100 people. The loss of the *Titanic* led to the calling of the International Convention for the Safety of Life at Sea in London in 1914.

The provisions of this convention with respect to lifesaving appliances

were adopted by Congress in the Seamen's Act of 1915. Now, every ship in a similar trade has lifeboat capacity to accommodate all persons on board, and in addition, buoyant apparatus or life rafts to accommodate 25 per cent of those on board. Further, passenger ships are required to be so subdivided in their construction that if two compartments are flooded, the vessel will remain afloat.

In 1915, large numbers of people boarded the excursion steamer *Eastland* in Chicago for a daylight trip on Lake Michigan. Before it ever left the dock, the vessel capsized, bringing with it to their deaths 812 persons. Investigation showed that the *Eastland* lacked stability. Now, passenger vessels are required to be inclined to assure that they have ample stability.

The passenger liner *Morro Castle* caught fire at sea off the New Jersey coast in late 1934. Before the fire had spent itself, 89 passengers and 35 crew members perished in the flames or in the sea. Here again, it took the shock of a disaster to launch Congressional inquiries and other investigations. The result was a flood of legislation, much of which had been repeatedly sought by the Bureau of Marine Inspection and Navigation.

These fires, collisions, boiler explosions, and capsizings, the dangers of which must have been recognized before their occurrences, brought about corrective legislation and stricter regulation and inspection. Casualties of types other than these were responsible for additional legislation, extending the jurisdiction to include the regulation of motorboats, of loading of vessels, of motor vessels, and of the pollution of waters, to mention but a few.

Federal Requirements

Last November, at the 28th Annual Meeting of the API, R. G. Watts of the Magnolia Petroleum Company presented a paper entitled "Regulations Covering Drilling Activities in Coastal Waters" at a group session of the division of production. In his address, he explained that in moving into coastal waters, your offshore operations become subject to rules and regulations of government agencies with which you were not previously involved. In great detail, he stated the requirements of those agencies. For the benefit of those of you who have not had the opportunity of reading that paper, I will briefly acquaint you with these requirements.

Plans having been made to erect a platform and derrick, a permit to construct them is required from the appropriate district engineer of the U. S. Army Engineers. If there is no unreasonable interference with navigation, the permit is granted. Once the construction becomes an obstruction, lights and fog signals must be displayed in accordance with the requirements of the Aids to Navigation Division of the Coast Guard.

The exact location must be reported, in order that a Notice to Mariners may be issued, so the Coast and Geodetic Survey, and the Navy Hydrographic Office can mark the obstructions on the navigational charts issued by those agencies. Conversely, prompt notice of removal of abandoned structures must be given; and they must be so removed that there will be no columns or piping protruding above the ocean floor which could foul the dragnets of fishing vessels or puncture the bottoms of passing vessels.

In the support of the operations, boats and larger vessels are required for the transportation of personnel and material, and for the construction of rigs. Depending upon their tonnages, means of propulsion, and use, they may be subject to documentation by the Collector of Customs; and to inspection and manning requirements of the Coast Guard to insure that they are safe for the purposes intended.

Radio communications between ship and shore will require licensing of such installations by the Federal Communications Commission; and the persons operating them will also have to have licenses from that same agency.

If the structure exceeds a height of 200 ft above the water, the Civil Aeronautics Authority may require a flashing red light atop the structure as a warning to aviators.

Government-Industry Cooperation

The expansion in your industry from the time of Drake's well in 1859 has been accomplished through tremendous changes and advancement. That one well has been multiplied and multiplied, until now there are more than 1,200,000 wells in 25 states. From the original pot stills, which produced only one product, the industry has expanded and improved its refining facilities so that today, more than 1200 products are made from crude oil. So also have there been comparable developments in the marketing and transportation fields. This growth was attained only after the overcoming of many difficulties.

The extension of operations into the Gulf has encountered new obstacles. The manner in which they have been attacked indicates you are not in waters over your heads. In meeting the problems of offshore

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operations, a most commendable approach has been made in the organization of the Offshore Operators' Committee, for which the companies concerned are to be congratulated.

The companies engaged in these operations recognized the factors involved in a new field. Their common problems were pooled in the Offshore Operators' Committee for study and presentation to Federal regulating agencies for equitable solutions. It is an example of government-industry cooperation which has, so far, been of advantage to both sides; and is a practice which is capable of further application for the common good of the oil industry, government agencies, and other interests.

Congress has recognized the desirability of the cooperation of industry and government. The Administrative Procedures Act, passed in 1946, requires that Federal rule-making bodies shall give adequate notice of proposed regulations, in order that those affected by them may have the opportunity of being heard.

Just what the Act seeks to effect was achieved ten years before its passage, when a section of your own industry sat down with representatives of the Bureau of Marine Inspection and Navigation for the purpose of preparing regulations covering tank vessels. Admiral Farley, Commandant of the Coast Guard, at the last annual meeting of the API, related at some length how a group of men from the division of transportation, experts in tanker construction and operation, worked continuously with the Government representatives in the preparation of regulations applicable to the construction, operation, inspection, and manning of tank vessels. He also told how, when the regulations were completed, they were used in the drafting of the very law which they were to implement. Right now, these very same groups are working on the first major revision of the Tank Vessel Regulations made necessary by advances made through the years since their enactment.

The petroleum industry in the U. S. in 1948 had an average investment of $17,400 per employe to provide tools and equipment for efficient operation.

★ ★ ☆

That is an outstanding example of cooperation which has proven to be of mutual benefit to both; an example of assistance to the government by industry on a matter of public safety. You can call it an example of self-regulation. The trend, with the Administrative Procedures Act, is toward industry self-regulation under government supervision. But with this privilege of self-regulation, there should be a corresponding obligation of self-enforcement.

Conclusion

Taking one last look around the horizon, you can see the ships, the fishing craft, and the oil rigs. Beneath the surface are the fishing grounds and the oil pools. On the surface are well-defined shipping lanes which are followed by ocean going vessels from the entrance of the Gulf to the deep water ports along the coast. Will the placement of rigs encroach upon those lanes? Will the producing wells contaminate the fishing grounds? If there is a gas blow, can a ship one mile, or two miles downwind provide the source of ignition which may spell disaster?

These are questions which must be considered. The appointment of the Offshore Operators' Committee is a step forward in discussion of these problems with Federal agencies. Other steps might be taken to meet on a common ground with the shipping and fishing industries which, together with your industry, are contributing to the prosperity of the nation, the State of Texas, and the other states along the Gulf Coast. ★ ★ ★

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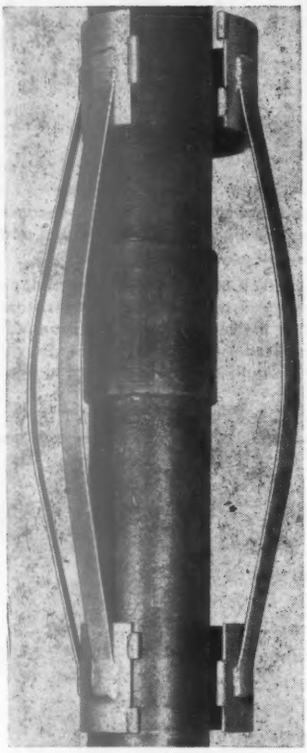

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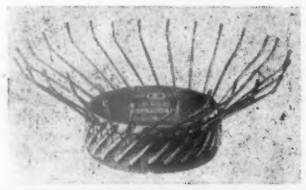

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What's Doing in DRILLING

Colorado's Dove Creek

Another oil producing well has been completed in the Dove Creek field of southwestern Colorado. It is the No. 1 Jesse White, about ¼ mile from the No. 1 Anna Driscoll, discovery well of 4 months ago.

The Driscoll is producing about 200 bbl of oil daily and its large gas flow is under contract to the government's Utah atomic plant. It is reported that a pipe line will be in operation by August.

Socony-Vacuum 1948 Drilling

Socony-Vacuum Oil Company, Inc., and its domestic affiliates completed 813 wells in 1948, more than in any year since 1941, it has been announced, with the result that the company's domestic production increased from an average of 190,000 bbl a day in 1947 to 210,000 bbl a day last year.

Of the 813 wells completed, 614 were oil wells, 95 gas, and 104 unproductive. Included in the total were 71 wildcat wells, 15 of which were oil wells, 8 gas, and 48 unproductive—an average of one producing well in each three wildcats drilled.

"Bart" Myers Honored

A luncheon, given by Paul Cavins for B. A. (Bart) Myers, retired vice-president of International Petroleum Company, Toronto, Canada, a subsidiary of Standard of New Jersey, was the occasion for a get-together of many of Myers' California friends and former co-workers.

Myers was in charge of drilling and production in Colombia, Peru, and Ecuador, South America, and in Canada. He retired January 1, 1949, after 45 years of service with the Standard Oil Company.

Reading clockwise from far end of the table: Paul Cavins, The Cavins Company; R. J. (Bob) Eiche, R. J. Eiche and Associates; L. S. (Shorty) Hamer, Hamer Oil Tool Company; Jack Harpster, Security Engineering Company, Inc.; H. G. (Hal) Haney, vice president, Thomas Pike Drilling Company; S. P. (Price) Duffield, Thornbury Company; R. B. (Bob) Block, The Cavins Company; Harold Therolf, Owner, Eason and Therolf Tool Company; C. W. (Waldo) Moore, manager, The Cavins Company; Onos Lindsay, sales manager, Eastman Oil Well Survey Corporation; T. J. (Tom) Martin, R. J. Eiche and Associates; Owen Lake, Export Manager, National Supply Company; William (Bill) Bettis, vice president, M. O. Johnston Company; Lee Chisholm, manager Ventura area, Shaffer Tool Works; K. E. (Kenny) Waggener, superintendent, Shaffer Tool Works; Arnett Norcott, retired general manager, International Petroleum Company, Peru; B. A. (Bart) Myers, retired vice-president, International Petroleum, Canada.

Drilling in Venezuela

Atlantic Refining Company has announced in its annual report that it completed 14 oil wells and one gas well in Venezuela during 1948. The properties being explored in the Tucupido and Pelayo areas are jointly owned by Atlantic and Pancoastal Oil Company, C. A.

Stansbury to Canada

M. H. (Curly) Stansbury is on his way to Calgary and Edmonton, Alberta, Canada, to ascertain how many rigs may be needed up there and whether satisfactory contracts are obtainable. "Curly" is president of Stansbury, Inc., which is currently operating three rigs in California, two for Richfield in the Cuyama, and one for Pacific Western, near McKittrick, California.

Wenk Heads Brewster Service

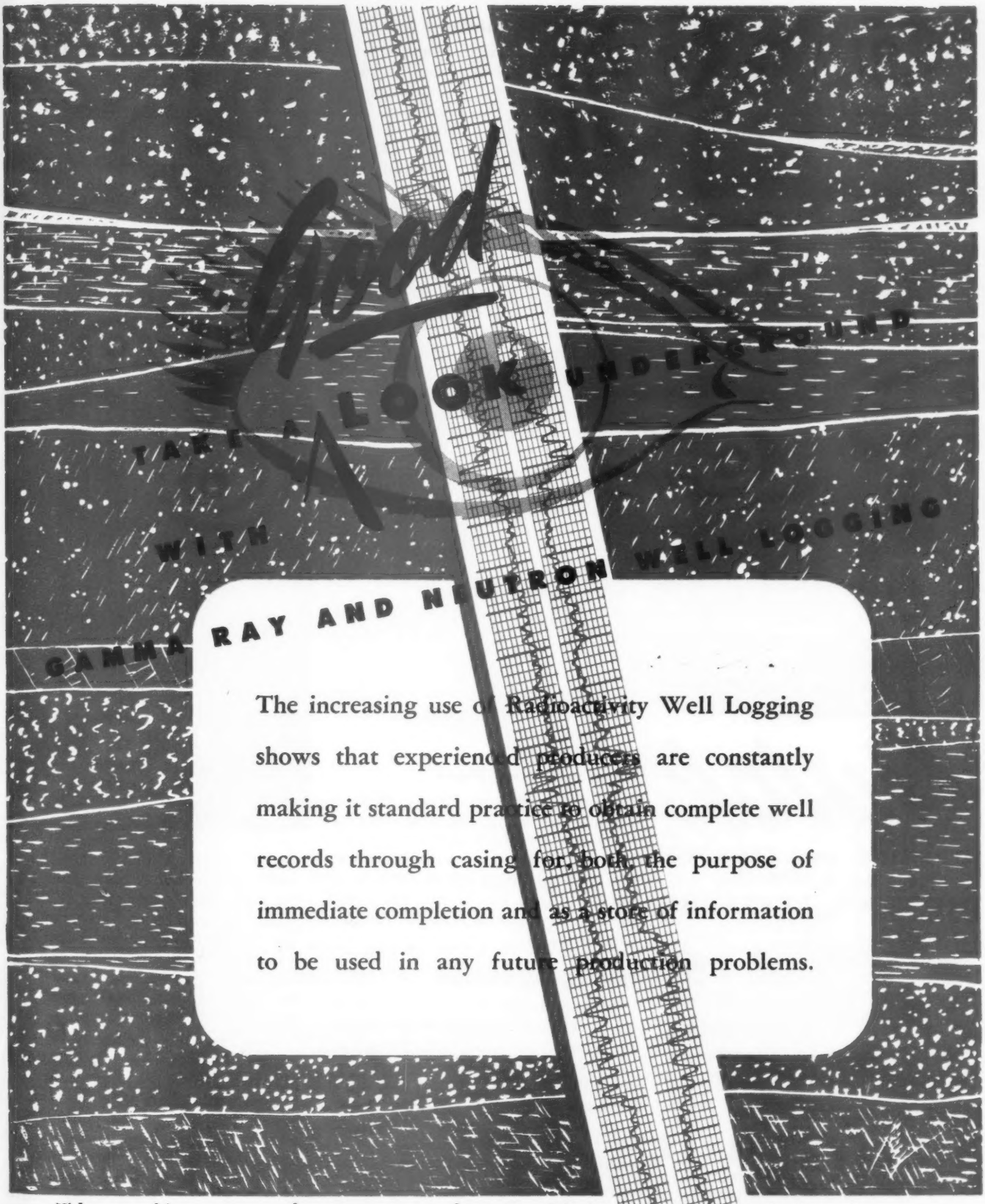
Herbert Wenk has been appointed by The Brewster Company, Inc., of Shreveport, Louisiana, to head its new service department. Wenk's broad engineering background and 15 years field experience has qualified him to direct the activities of this newly orgaized department.

According to Wenk, the Brewster service department is prepared to service Brewster drilling rigs all over the continental United States and drilling rigs of any make in the Mid-Continent area. The department has been equipped with a fleet of especially outfitted trucks.

Illinois Activities

A new oil pool discovery, the Ste. Marie West in Jasper County, and eight extensions in Illinois were reported for the month of February by the state geological survey. Most active areas in the state during the month were the Maud North Consolidated and Allendale pools in Wabash County, Centralia in Clinton County, and Assumption North in Christian County.

B. A. "Bart" Myers, retired vice president of International Petroleum Company, is honored at dinner.



The increasing use of Radioactivity Well Logging shows that experienced producers are constantly making it standard practice to obtain complete well records through casing for both the purpose of immediate completion and as a store of information to be used in any future production problems.

These licensees have run almost 20,000 Radioactivity Logs.

Well Surveys, Inc.

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EXCLUSIVE 500 TON SPECIAL

You can always break the joint when you use Jimmie Gray Compounds! Each one is engineered to do certain specified jobs best!
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Both new compounds have the same dependable quality, the same money-back guarantee as the widely used Jimmie Gray 500 TON Special!
LONG-LIFE DRILL COLLAR COMPOUND

SOLD BY SUPPLY STORES EVERYWHERE
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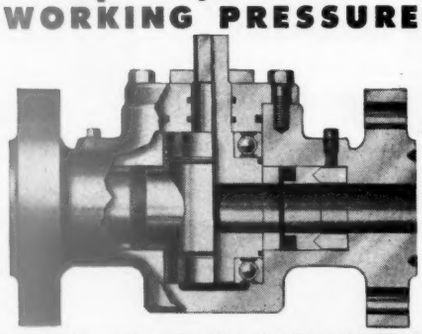
OPENING and CLOSING
up to 5,000 lb.
WORKING PRESSURE



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Mexican Tidelands

Included in Mexico's contract with Pauley and associates was the first agreement covering tidelands exploration. Pemex has announced the profit margin for offshore drilling would be 18 per cent rather than the 15 per cent for normal exploration.

Parker With Mud Products

Mud Products, Inc., of Tulsa, Oklahoma, has named E. W. Parker to head the firm's equipment division in the Houston, Texas, area, where he has served with supply companies for many years.

With headquarters in Houston, Parker will service and act as an advisor on mud handling problems aiding independent and company drilling operations throughout his territory. He will replace Sam Dyer, former representative in the Houston territory. Dyer left the Mud Products organization to assume partnership duties with his brother, Joe Dyer, an independent operator in Casper, Wyoming.

Large Kansas Producer

Largest potential producer reported by Cities Service Oil Company (Delaware) for the week ending March 24 was the Pinkerton No. 12 in the Ray Pool of Phillips County, Kansas. This well was good for an initial of 1272 bbl of oil daily.

Reed's Houma Plant

In continuance of its program of keeping the company as modern as the times, the Reed Roller Bit Company of Houston, home of Reed rock bits, super shrink-grip tool joints, and other oil field equipment, has completed a new service plant at Houma, Louisiana.

Drilling Mud School

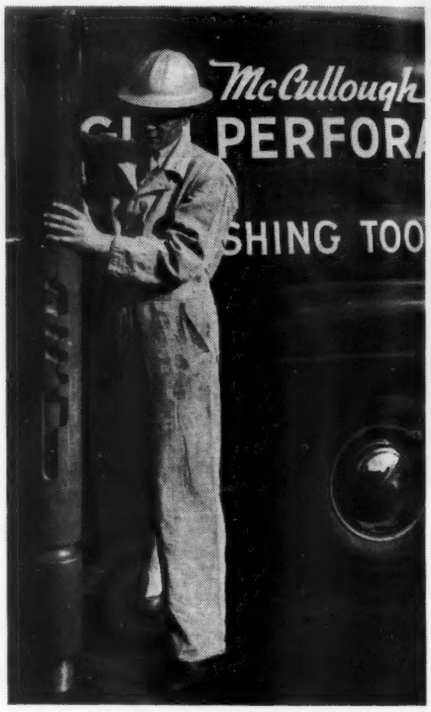
Stanolind Oil and Gas Company has developed a series of short courses in technical subjects for its young engineers. Now in progress is a school in drilling mud technology, and similar work in reservoir engineering has been completed. Courses in various other phases of oil-producing operations are under consideration.

The "mud school" is being attended by 10 young engineers, all of whom have had field experience in producing operations. They spent two weeks at the Stanolind general office and research laboratories in Tulsa, studying well completion methods and typical mud problems and accepted practices under the guidance of experienced lecturers. Then the trainees were sent back to the field for six weeks of additional study.

Rotary Jars

Two new world records for rotary jarring were set by McCullough Tool Company, Los Angeles, in the Superior Oil Company world's deepest well (abandoned at 18,734 ft), Limoneira No. 1 wildcat near Ventura. Never before in the history of the oil industry, has stuck pipe been released at such a great depth, and never before were rotary jars employed in such a deep well.

The McCullough jars were used in the drill pipe string during drilling



operations below 17,159 ft as a precautionary measure. Some time later the drill pipe became stuck at 18,136 ft, and the 4-in. rotary jars were used. The jars were in continual operation for 22½ hours but due to the fact that drill collars were not used above the jars for additional weight the string would not come loose.

To correct this, the safety joint below the jars was released and the drill pipe pulled from the hole. Nine, 6-in., 40-foot drill collars were then put on above the jars and the complete assembly lowered into position again and the safety joint re-engaged. After 8½ hours of additional jarring the drill pipe was successfully jarred loose.

Florida Well Completed

Humble Oil and Refining Company has completed its No. B-2 Lee Tidewater Cypress Company in the Sunniland field of Collier County. The well flowed 750 bbl of 24-gravity oil on 24-hr test through ⅜-in. choke. It is the ninth producer in the state.

Wilson

Mogul TORCAIR RIG

WITH SENSATIONAL NEW Air Control

- FOR DRILLING WELLS TO 4000 FT. WITH 4½" DRILL PIPE.
- FOR SERVICING WELLS TO 8000 FT. WITH 2½" TUBING.
- FOR SERVICING WELLS TO 16000 FT. WITH 2½" TUBING (using 15" Double Rotor Hydromatic Brake).

Complete rig on one skid! Full panel air control! Incomparable in its rated capacity class for portability! WILSON MOGUL TORCAIR RIGS incorporate the advanced AIR CONTROL and adjusted TORQUE APPLICATIONS of the larger WILSON RIGS . . . it is particularly designed for deep well servicing, and like all WILSON machines, it does the job like a thoroughbred. Compactly built with large air compressor and air tank, it measures less than 8 feet overall width, with catheads removed. WILSON Air-Tube Clutches in the drum; automatic feed brake enables the driller to set brake and leave it in one position. Numerous other features worth looking into! Write for Bulletin 174 — it's just off the press!

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AMERICA'S LARGEST BUILDER OF POWER RIGS AND WINCHES — THERE'S A REASON!

EXPLORATION ACTIVITIES

1948 Geophysical Activity

The Society of Exploration Geophysicists, in the recent convention at St. Louis, heard that geophysical exploration activity, both foreign and domestic, reached an unprecedented high mark in 1948. The report was made by E. A. Eckhardt, vice president of Gulf Research and Development Company.

Eckhardt reported that seismic operations in the United States increased 17.4 per cent over 1947, and similar substantial increases were made in world-wide seismic operations, with Canada doing 5.8 per cent of the seismic work, becoming second to the U. S., which recorded 79.6 per cent of the total. Operated in the U. S. in 1948 were 520 seismograph parties and 125 gravity meter parties. The expenditure in the U. S. for geophysical operations reached $125,000,000. Three billion barrels of oil were found in this country in 1948, so that the cost of geophysical work was 2.5 cents per bbl, or 1 per cent of the value of the product. The 1948 effort added a billion barrels to the reserve, then, in spite of the tremendous two billion barrel consumption.

Eckhardt also analyzed the discovery time schedule for major oil fields in the United States. The first peak of 11 major discoveries was attained in the period 1900-05, brought about by aggressive wildcat drilling. The second peak of 13 major discoveries came in 1915-20, under the impact of newly applied geology. The last peak occurred in 1925-30, when 27 major fields resulted from the impact of geophysics. The periods 1930-35 and 1935-40 registered 19 major fields each, and the figures for later periods are still indeterminate.

For the first time, Eckhardt said, data on use of geophysics in the mining industry are available. They indicate 1948 expenditures of $2,000,000, of which 49 per cent was done by Canadian industry, with the U. S. a poor second with 20 per cent. The speaker also reported a worldwide increase in use of airborne magnetometer which mapped more area than all seismic operations.

West Texas Deep Well

An Ellenburger discovery, the deepest oil producer in West Texas, has been recompleted by Magnolia Petroleum Company. 1-A TXL, in north central Upton County, flowed 1167 bbl of 52.3 gravity oil in 24 hr. Discovery produces through perforations at 12,700-60 ft and 12,780-820 ft.

Another Tidelands Well

Humble Oil and Refining Company has completed another tidelands oil well 15 miles off Terrebonne Parish, Louisiana. It is about 40 miles southwest of Grand Isle tidelands field.

The No. 1 Timbalier, block 34, was completed at 9550-58 ft, flowing at a daily rate of 456 bbl based on a 2-hr test through 3/16-in. choke. Gas oil ratio was 593 to 1.

Gulf Oil Discovery

Gulf Oil Corporation has completed its No. 135 Keystone Cattle Company for a new oil discovery from the Devonian in Winkler County, West Texas. Flying-W has been suggested as a name for the new field. It is 6½ miles from the Keystone Devonian field, also in Winkler County.

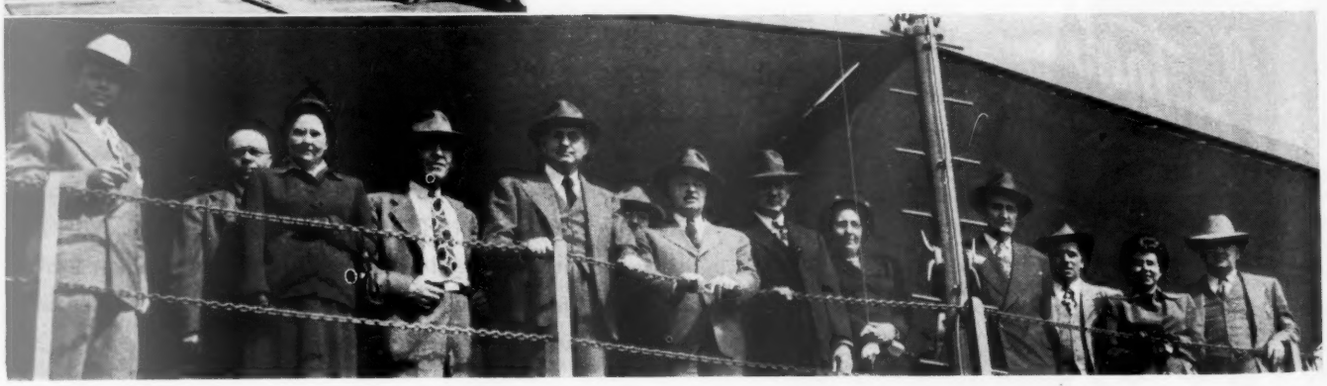
The well flowed at the rate of 1557 bbl of 38.4 gravity crude a day on its completion test. Production is from above 9744 ft.

Phillips Tests in Wyoming

Phillips Petroleum Company and Pioneer Oil Corporation have opened production in the Tensleep sand zone in the Golden Eagle field of Hot Springs county, Wyoming, at their No. 1 Golden Eagle. After drill-stem test the well was deepened.

Top of the Tensleep was reached at 9336 ft and the well was tested at 9344-81 ft. After tests in which some water was produced, another test gave a flow of 21 bbl of clean 46.7 gravity oil per hour for 11 hours.

Tensleep is the second new production zone opened by this well. Previously the Phosphoria was tested at 9051-74 ft, recovering green oil.



Inspection party aboard Magnolia's offshore drilling barge No. 4 in the Bethlehem shipyard at Beaumont on February 19, 1949, included: W. B. Powers, assistant superintendent, Gulf Coast division, Houston; F. R. House, Bethlehem, Dallas; Mrs. House; S. C. McFarlane, Magnolia, Dallas; J. W. Newton, vice president and manager refining, Magnolia, Beaumont; D. E. Bryan, Magnolia, Dallas; R. M. Chan, vice president, Magnolia, Dallas; A. E. Chester, vice president and manager production, Magnolia, Dallas; Mrs. M. V. C. Bradley; M. V. C. Bradley, assistant manager production, Magnolia, Dallas; I. C. Smith, Bethlehem, Tulsa; Mrs. W. B. Powers; John B. Goodrich, superintendent Gulf Coast division, Houston, Texas.

DRILL CUTTINGS ANALYSIS

reservoir road markers

If it's worth drilling, it's worth logging.

With the techniques and facilities for accurate Drill Cuttings Analysis available in every active drilling area, no exploratory effort can reasonably justify the inefficiency of "high balling" from grass roots to total depth and coring *only* those formations which were earmarked geologically when the location was staked. Likewise, the procedure of coring through *all* probable productive zones is equally as uneconomical.

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"If it's worth drilling, it's worth logging."

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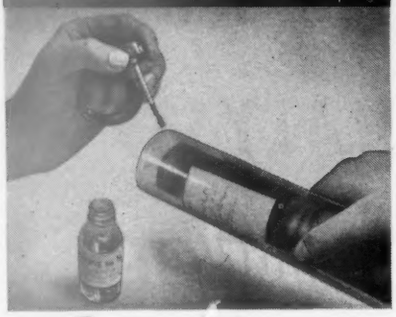
3000 Bbl Daily Discovery

The Kansas Corporation Commission has reported that the No. 1 Marcotte, a new Rooks County field opener, has earned a 3000 bbl daily potential productivity rating.

Protect Your Cores



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East Texas Geological Society officers for 1949 are: Vice President John C. Price, Magnolia Petroleum Company; President Pete S. Schoeneck, Atlantic Refining Company, and Secretary-Treasurer G. C. Clark, Stanolind Oil and Gas Company, all of Tyler, Texas.

Warren Opens Pool

Warren Oil Corporation has opened a new Mississippi lime pool in Jack County, Texas, with its C. O. Tilghman No. 1, which flowed 410 bbl of oil through 23/64-in. choke in 11 hr and 40 min. The well made 36.8 bbl of oil per hr during the last five hours of its official test. Pay was topped at 5408 ft.

Virginia Gas Field

The Clinchfield Coal Company, a subsidiary, of the Pittston Company, has found gas in its No. 1 well located some 20 miles northeast of Dante, Virginia. This company, owning vast acreage of coal in Wise, Dickenson, and Russell counties, Virginia, has started a program of testing its holdings for oil and gas.

The No. 1 well found an estimated 450,000 Mcf of gas in the Price formation at a depth of 3849 ft. The formation is said to have thickness of 175 ft. Well No. 2 is 30 miles from No. 1.

Std of Texas Develops Field

Standard Oil Company of Texas has announced the results of the official potential tests of their second and third wells in the North Snyder Field in Scurry County, Texas. During the 24-hr official potential test of Standard's second well, which has been designated as Jessie Brown 3-1, the well flowed 546 bbl of oil with a gas-oil ratio of 885 through a ¼-in. choke. During the 24-hr test of Standard's third well, designated Jessie Brown 2-2, the well flowed 752 bbl of oil with a gas-oil ratio of 806 through a 22/64-in. choke.

In announcing these official potentials, Standard's officials pointed out that the North Snyder Field was discovered in November of 1948 by the successful completion of Standard of Texas' Jessie Brown 2-1. This discovery well flowed 528 bbl of oil with a gas-oil ratio of 1225 during the official 24-hr potential test through a ¼-in. choke.

The discovery of the North Snyder Field is the result of geological and geophysical work which was initiated in 1944 in the Eastern Shelf Area of Texas by Standard Oil Company of Texas. This early work concentrated on the study of the stratigraphy in this area. A detailed seismograph survey was subsequently made and the discovery well was located on a geophysical structure and was drilled to test Pennsylvanian lime potentialities. The top of the Canyon Lime of Pennsylvanian Age which is the present producing horizon was encountered at a depth of 6260 ft in the discovery well. Approximately 600 ft of section is believed to be productive.

Hunt Finds New Zone

Hunt Oil Company has obtained the first Cotton Valley oil production in the East Haynesville field of Claiborne Parish, Louisiana, with its No. 1 S. W. Owens. The well flowed 206 bbl of oil on ¼-in. choke in 17 hours from perforations at 8588 to 8600 ft.

Complete **ENGINEERING ANALYSIS**

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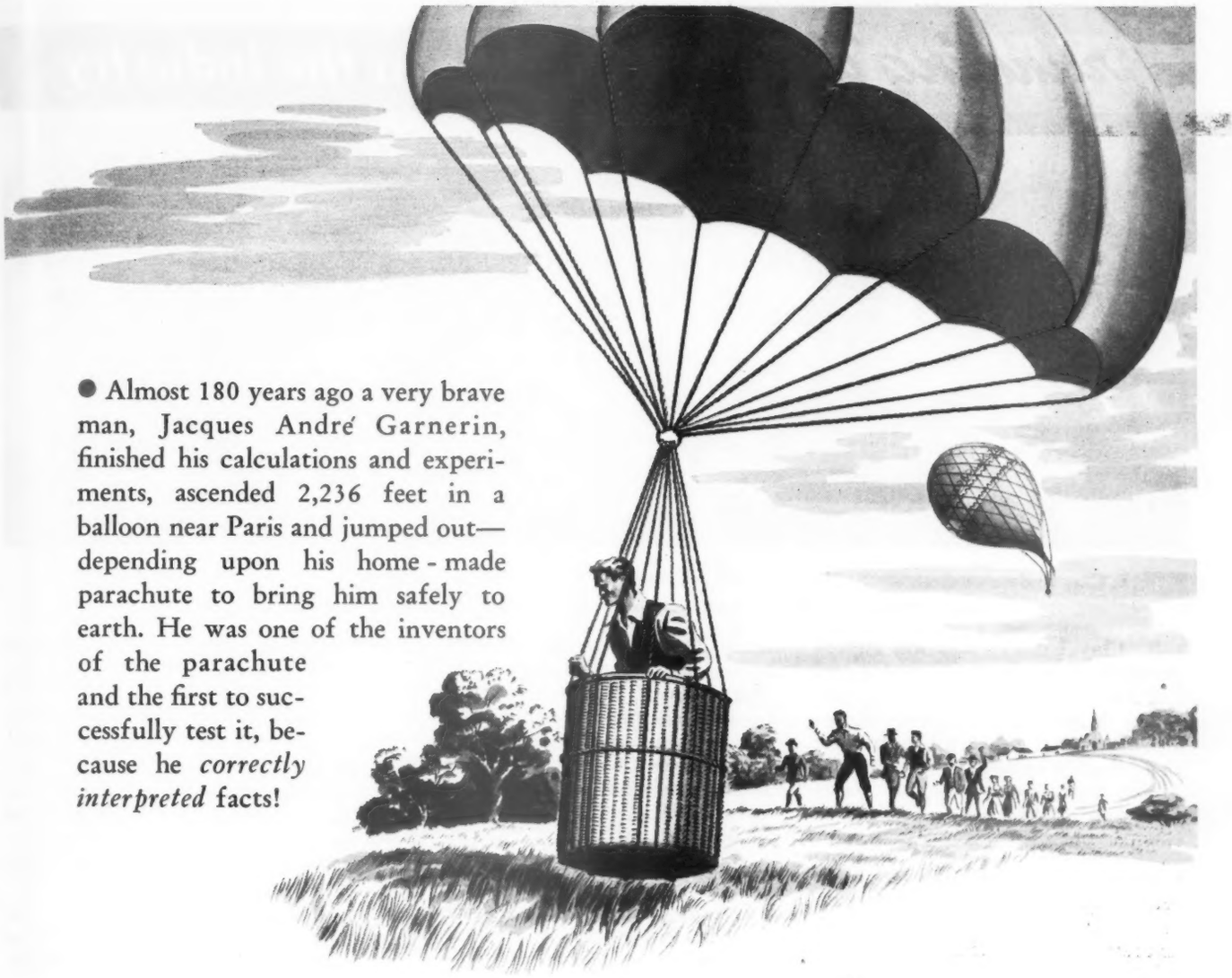

● Almost 180 years ago a very brave man, Jacques André Garnerin, finished his calculations and experiments, ascended 2,236 feet in a balloon near Paris and jumped out—depending upon his home-made parachute to bring him safely to earth. He was one of the inventors of the parachute and the first to successfully test it, because he *correctly interpreted* facts!

● And in today's business, especially in the costly drilling of oil wells, *correct interpretation* of the facts pays off. Good equipment, trained crews and correct interpretation of subsurface conditions—these have been the factors resulting in McCollum Exploration Company's leadership for over a quarter of a century.

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R. Clay Underwood | Marvin E. McCullough | Charles N. Prothro | Fred Sehmann

New officers of North Texas Oil and Gas Association inaugurated March 1.

▸ **R. Clay Underwood** was elected president of the North Texas Oil and Gas Association, to serve for the year ending March 1, 1950. Other officers are: **Marvin E. McCullough,** first vice president; **Charles N. Prothro,** second vice president; and **Fred Sehmann** re-elected as executive vice president.

▸ **Ronald E. Griffiths,** for three years supervisor of the American Steel and Wire Company research laboratory in Cleveland, has been appointed assistant director of research for the company, H. B. Jordan, vice president-operations of the U. S. Steel subsidiary, has announced. Griffiths has been associated with American Steel and Wire in various technical assignments since June, 1937. In his new post, as assistant to Walter O. Everling, director of research, he succeeds **Willis T. Cramer,** who has been transferred to the post of division metallurgist, for corrosion-resisting alloys, in the company's metallurgical department.

▸ **Roger Henquet,** former vice president and general manager, was named executive vice president of Schlumberger Well Surveying Corporation and **D. C. McCann** was promoted to vice president and manager of operations in a list of promotions and personnel changes announced this week by the company. McCann will be assisted in his Houston headquarters by **J. A. Bodin, R. Legeron,** and **E. F. Stratton.**

In other changes, the Kansas, Oklahoma, North Central Texas, and Permian Basin divisions of Schlumberger were consolidated into one division with headquarters in Tulsa, Oklahoma. The Tulsa headquarters will be under the management of **R. G. Hamilton. R. D. Ford,** former public relations manager for Schlumberger, has been transferred from Houston to Tulsa to serve as assistant manager of the new and enlarged Tulsa division.

Under direction of the Tulsa division, **L. G. Chombart** will serve as manager of the Kansas division, **L. A. Puzin** as manager of the Oklahoma division, **R. I. Seale** as manager of the North Central Texas division, and **A. Morazzani** as manager of the Permian Basin division. **W. R. Mills,** former manager of the Oklahoma branch, will transfer to Houston to serve as assistant to R. R. Rieke, manager of the Gulf Coast area.

▸ **George B. Kitchel** of Houston, Texas, has joined Kerr-McGee Oil Industries, Inc., as assistant to Travis M. Kerr, vice president in charge of the company's drilling department, with headquarters in Oklahoma City. He will be in charge of the company's field operations.

For the past seven years, Kitchel has been engineer in charge of the drilling equipment division of Humble Oil and Refining Company, serving as intermediate manager between production department management and field personnel.

C. J. Colby of Houston, Texas, has joined Kerr-McGee Oil Industries, Inc., as director of purchases and material, it was announced by Dean A. McGee, executive vice president. Colby will coordinate the purchasing, transportation, and materials departments in the company's Oklahoma City headquarters offices.

▸ **John G. Staudt,** vice president and general manager of Dowell Incorporated has been named to the board of directors of United Oil Well Service, S.A., an associate company with headquarters in Caracas, Venezuela.

Herbert Hoover, Jr., son of former President Hoover, was elected president of the company. Hoover replaces **C. W. Fowler, Jr.,** who died last fall.

Herbert A. Koch, general sales engineer for Dowell has been named head of the company's Fort Worth, Texas, office.

C. O. Moss

▸ **C. O. "Cleve" Moss,** for the past 20 years with Deep Rock Oil Corporation, has retired to enter the independent petroleum consulting field, with offices at 208 Midco Building, Tulsa, Oklahoma. During recent years, Moss has been technical and engineering assistant to the executive management of Deep Rock. He will engage in general engineering practice as applied to oil and gas production, with emphasis on valuation and appraisal work.

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GUN PERFORATOR SERVICE

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4. **MAXIMUM PENETRATION** of bullets into the formation, as proved repeatedly in competitive field tests.
5. **GUNS TO FIT EVERY CONDITION.** McCullough employs more than 30 different types and sizes of guns.
6. **ALL SIZES OF BULLETS** from $\frac{1}{8}$" dia. up to $\frac{3}{4}$" dia., to fit every possible need.
7. **BURRLESS BULLETS,** giving a completely burr-free hole, eliminating casing scraping, with *no* sacrifice of penetration.
8. **NO LOST TIME.** McCullough's simpler, lighter equipment cuts setting-up and moving-out time, speeds up every job.
9. **EXPERIENCED MEN.** With years of experience behind them, thoroughly-trained McCullough gun-perforating crews do their jobs quickly, efficiently, safely.

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WYOMING: Casper

EXPORT OFFICE: 30 Rockefeller Plaza, New York 20, N. Y.

▸ **J. M. (Jack) Miller,** Humble Oil and Refining Company, has replaced **G. B. Kitchel,** resigned, as drilling equipment engineer in charge of the drilling equipment division. Other changes involving production department supervisory personnel follow.

W. H. Stephens, district chief clerk, Houston construction district, has been transferred to the Katy gas cycling plant construction district. He replaced **I. M. Howell,** who was promoted to assistant chief clerk in the gas construction division in Houston.

William J. Allen, district clerk, Imogene district, was promoted to district chief clerk of the Flour Bluff gas plant construction district.

Bert R. Williamson has been named marine equipment material pusher of the marine equipment division. **J. J. Martin** was transferred from the New Orleans marine construction district to the marine equipment division, Houston, as chief clerk.

H. L. Landua and **G. F. Abendroth** have been transferred to the petroleum engineering division, Houston, as supervising petroleum engineers. Landua formerly was district petroleum engineer of the Odessa District, and Abendroth was district petroleum engineer of the Avery Island district. **A. J. Shaw,** Means district petroleum engineer, was transferred to the Odessa district to replace Landua, and **V. E. Skalnik,** petroleum engineer at Means, was promoted to Shaw's previous position. A successor to Abendroth at Avery Island has not yet been named.

A. M. Nixon, gas plant repairman, 1st class, has been transferred from Katy gas cycling plant to the North Crowley district for work as mechanical supervisor.

▸ **J. P. Magoffin** has been promoted to general sales manager with the retirement of **J. C. Ballagh,** as general

J. P. Magoffin

J. B. Merritt

manager of Patterson-Ballagh, Division of Byron Jackson Company. This promotion moves Magoffin up from Mid-Continent sales manager, the position he has held since 1943.

John B. Merritt will continue in the capacity of assistant general manager of Patterson-Ballagh.

At an AIME meeting of the North Texas Section in Wichita Falls on March 25 were: Don L. Harlan, The Texas Company at Fort Worth, chairman of the section; Tom B. Morton, Halliburton Oil Well Cementing Company, Wichita Falls, a director of the section; Joe B. Alford, editor of *Journal of Petroleum Technology;* William L. Horner, chief engineer of Barnsdall Oil Company, guest speaker; I. E. Curtis, chairman Hull-Silk Pool Operators Committee, and vice chairman of the section; Patrick H. Reardon, Gulf Oil Company, Fort Worth, secretary of the section; and William H. Strang, executive secretary of the Petroleum Division of the AIME, Dallas.

▸ **E. G. Robinson,** New Orleans area manager for Shell Oil Company, Inc., has left to assume a position as vice president, exploration and production, with Shell Oil Company of Canada, Ltd. **Bouwe Dykstra,** until now area manager at Midland, Texas, replaces Robinson in New Orleans. The new Midland area manager is **B. L. Ryan,** formerly land manager for Shell's regional office at Houston.

▸ **Donald S. Grubbs** has been named manager of the California Division of Oil Well Supply Company, U. S. Steel subsidiary, effective April 1, Lloyd Tracy, vice president, has announced.

Warner F. Parker, long identified in California sales for the company, assumes the newly established position of sales manager in the division. Both will have headquarters at Los Angeles.

▸ **Arch R. Boyd** has been named sales representative with headquarters at Edmonton, Alberta, Canada, for Byron Jackson Company. He will handle the sales and service of the complete line of Byron Jackson and Patterson-Ballagh equipment after completing a training tour of the main factories and visiting the oil fields of California, Texas, and the Rocky Mountains to study technique.

▸ **Walter Brown** has been promoted to chief engineer of The Brewster Company of Shreveport, Louisiana, announced Harry S. Marioneaux, president and general manager. Brown has been connected with the company as assistant chief engineer for more than a year. In his new position he will be in charge of the design and mechanical engineering for all Brewster matched drilling equipment.

▸ **John Z. Linsenmeyer** has been named manager of mining, petroleum, and chemical engineering for the Westinghouse Electric Corporation, announced J. C. Fink, manager of the company's industry engineering department. Linsenmeyer, who joined Westinghouse in 1937, succeeds **Phelan McShane,** who has been appointed consulting mining engineer for the company.

▸ **Thad Randolph** has been named sales manager of Oil Base, Inc. He will be stationed at the home office and plant at Compton, California, in charge of sales for Black Magic oil base drilling fluid, White Magic oil-emulsion mud, and OB mud guns.

Frank Kinney has become a member of the sales engineering staff of the company. He will be in the Gulf Coast area after a training period in California.

Frank Lindeman, Jr.

▸ **Frank Lindeman, Jr.,** was recently promoted to operating superintendent of Stanolind Oil and Gas Company's producing department.

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. . . is available—day or night—to repair BREWSTER rigs anywhere in the United States, or ANY rig located in the Mid-Continent Area.

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Completely equipped and manned by trained, experienced personnel, the Brewster Service Department is devoted exclusively to field service and repair of Brewster rigs *anywhere* in the U. S., or any make drilling rig in the Mid-Continent Area. When breakdowns or accidents shut down your operations, call the Brewster Service Department for replacement parts and fast, expert repair service. Night or day, a Brewster Service Man will be on his way to your drilling location by truck—or by air if necessary! A folder is available describing the facilities of the new Brewster Service Department—write for your copy today.

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The BREWSTER COMPANY, Inc.

SHREVEPORT, LOUISIANA

BREWSTER MATCHED Drilling Equipment

▸ **Clarence O. Woker,** manager of Oil Well Supply Company's Centralia, Illinois, store for the past 18 months, has been appointed assistant district material supervisor of Illinois.

R. R. George has been named division office manager of "Oilwell's" Gulf Coast Division headquarters office at Houston.

M. F. Wellman, manager of the Albany, Texas, store since October, 1947, has been named manager of the Wichita Falls, Texas, store. He is succeeded by **A. G. Abbott,** who has been a field representative at Albany for the past six months.

▸ **George E. Dunlap,** former division landman at Dallas, Texas, was named manager of the newly-created Canadian Division of Sun Oil Company Production Department with offices in Calgary, and **George E. Bentley,** who has been identified with Sun's Canadian exploration for the last three years, has been placed in charge of field operations.

After receiving a degree in petroleum engineering from the University of Tulsa in 1939, Dunlap joined Sun Oil Company as a roustabout in the Henderson, Texas, area. Later that year he was transferred to the land department at Dallas, Texas, where he served until the outbreak of World War II. He was a naval officer for more than three years. Returning to Sun Oil Company on December 1, 1945, he was named assistant to the manager of the land department at Dallas, and became division landman in 1947.

Bentley joined Sun Oil Company shortly after graduating in geological engineering from Texas Agricultural and Mechanical College in 1937. His first job was in connection with pipe line operations at Sun Station, near Beaumont, Texas. The following year he was transferred to the production department as a petroleum engineer, and in October, 1944, he was promoted to assistant field superintendent at Sour Lake. Prior to his new appointment he was field superintendent at Amherst, Canada.

▸ **Herman H. Vaughn,** who has been credit manager of National Supply Company's Texas Division, has been elected assistant treasurer of the company. Succeeding Vaughn is **Wallace P. Smith,** now assistant division credit manager.

▸ **George F. Barnwell** has been appointed exploration department manager of Standard-Vacuum Oil Company. A petroleum geologist since 1925, Barnwell has been active in oil exploration operations in the U. S., Indonesia, and New Zealand and spent five years in an advisory capacity with a Standard-Vacuum affiliate in The Hague. Prior to his coming to New York, he had been exploration manager for Standard-Vacuum Petroleum Maatschappij, Stanvac's petroleum-producing affiliate in Sumatra.

George F. Barnwell

▸ **Charles B. (Boots) Kennedye** died of a heart attack at his home in Kirkwood, Missouri, March 13. Kennedye was active in various petroleum development enterprises in the past 20 years and shortly before his death he became affiliated with Key Company as a product development engineer.

Use Acme Cable Tools

TRUSTWORTHY SINCE 1900

Acme 18" B. & R. Safety Wire Line Drilling Clamps —for wells deeper than 3000'. (See Fig. 103)

Also: Acme 12" Clamp (see right) for shallow wells, not over 3000'.

10 Simple Parts... Perfect a 9-to-1 Favorite

See Acme's latest Catalog and Manual in Composite Catalog (Vol. 1). Or mail penny postal TODAY for your copy . . . chock-full of valuable information for every Cable Driller.

Yes, it's 9-to-1 they're Acme W. L. Drilling Clamps used east of the Mississippi . . . a proud record, built upon the QUALITY that assures greater service and safety.

Their 10-simple parts . . . fashioned of uniform, rigid specification, premium-grade steel . . . correctly heat-treated in our electrically controlled furnaces . . . for super-load carrying stamina . . . are the proven REASONS why.

Acme's 18" (deep well) Clamp weighs only 173 lbs. 200-ton breaking load . . . 6-to-1 safety factor. Non-fouling safety links. Perfectly balanced for 1-man hitch-on. 25-ton load gripping surface. Our 12" Clamp has same exclusive features, for 15-ton loads . . . weight, 160 lbs.

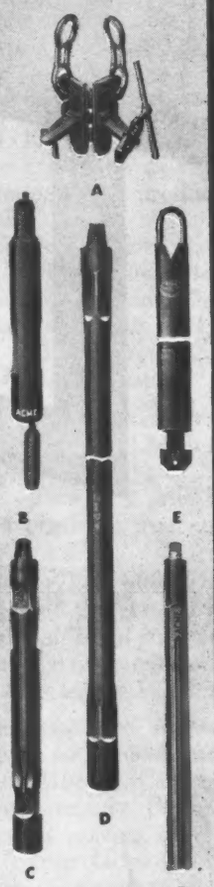
It's their EXTRA inner-qualities . . . steel to exacting analysis, engineered perfection, patented features, and 49-years' backlog of master-craftsmanship . . . that make Acme Clamps the 9-to-1 favorite and your No. 1 Trustworthy Buy.

Fig. 103

Front View

See other Acme Drilling Tools in panel (right) . . . for more of EVERYTHING you need in a Trustworthy String.

More of EVERYTHING You Need in an Acme String . . .



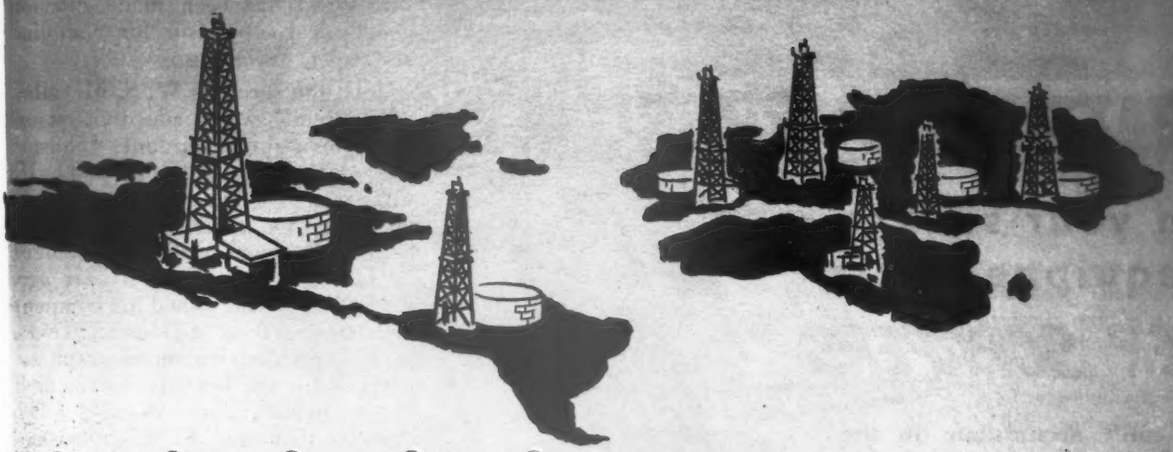
A—Wire Line Clamp, 12"
B—Presser Swivel Socket
C—Drilling Jar
D—Drilling Stem
E—Bailer
F—Drilling Bit

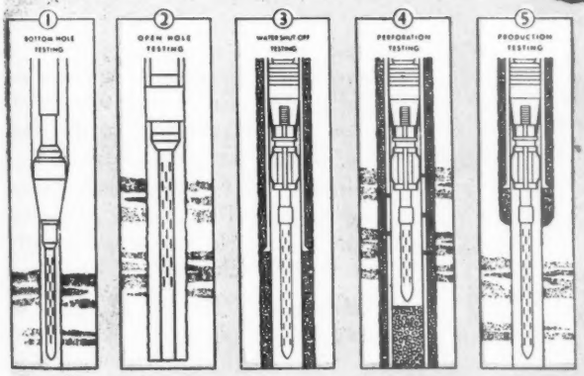
Acme Fishing Tool Co.
PARKERSBURG, W. VA.
Export Office: 19 Rector St., New York 6, N. Y.

ACME DRILLING & FISHING TOOLS Since 1900

First choice...

FOR PREVIEWING WELL POTENTIALS





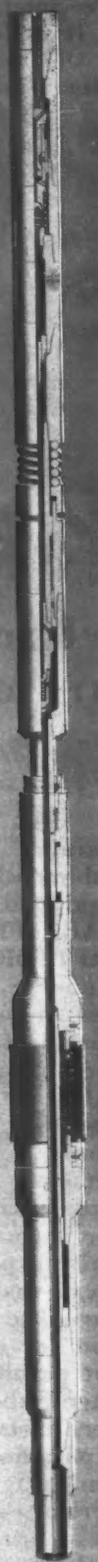
Check these important uses of the JOHNSTON FORMATION TESTER

- Determining the productive possibilities of all zones encountered during the course of drilling. (See Figs. 1 and 2)
- Determining the effectiveness of the water shut-off on cemented casing, whether shoe or squeeze job. (See Fig. 3)
- Determining the effectiveness and productive results of perforating jobs in casing. (See Fig. 4)
- Determining the productivity of a zone in a completed well before landing a liner or oil string, but after the water string is set. (See Fig. 5)
- Determining the productivity increase of an acidizing job.
- Determining the exact location of a fracture or leak in casing.

The JOHNSTON FORMATION TESTER

The Johnston Formation Tester is relied upon by operators throughout the world for determining the productivity possibilities of sands encountered in drilling wells as they are penetrated without the expense of setting casing. Its wide range of applications makes it adaptable to every formation testing job on the lease and provides the ultimate in tester accuracy and safety.

For complete information on the time and money-saving advantages of Johnston Testing Methods and Equipment write for illustrated brochure.



Why set casing before you know?

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"Servicing California-Permian Basin-Rocky Mountain Areas"

BRANCHES
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5702 Navigation Boulevard, Houston, Texas
"Servicing Mid-Continent and Gulf Coast Areas"

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Abilene, Alice, Cisco, Graham, Throckmorton, Tyler, Victoria, Wichita Falls, Texas; Lake Charles, Louisiana; Magnolia, Arkansas; Laurel, Natchez, Mississippi; Chickasha, Oklahoma; New Harmony, Indiana; Fairfield, Illinois

▸ **R. D. Faxon** has been appointed sales engineer with headquarters at Alice, Texas, for Byron Jackson Company, Oil Tool Division. After his discharge from the AAF at the end of Word War II, Faxon was employed by Socony-Vacuum Oil Company as a petroleum engineer at Zulia, Venezuela.

▸ **John H. Brown,** former floorman at Ellinwood, Kansas, for The Continental Supply Company has been transferred to Russell, Kansas, as store manager, succeeding **Lawrence E. Young,** who has been appointed field salesman at the same location.

▸ **Sylvain J. Pirson,** an engineer with wide experience in the field of reservoir engineering, has been appointed a special research associate at the Stanolind Oil and Gas Company research laboratories in Tulsa. Pirson comes to Stanolind from Pennsylvania State College, where he was on the faculty for more than 12 years. He taught petroleum engineering, reservoir engineering, geophysics, and geochemistry. A native of Belgium, Pirson was graduated from the University of Louvain in 1929 with a degree in mining civil engineering. Then he came to the United States on a two-year fellowship. He received an MS degree in petroleum geology from the University of Pittsburgh, Pennsylvania, and a DSc degree in geophysics from the Colorado School of Mines.

Bryan E. Mitchell, Jr., was transfered to Stanolind's Tulsa general office, producing department, as a petroleum engineer. He was formerly assigned to the Turtle Bay area, Liberty, Texas.

Eugene C. Carlson was made a process engineer at the research laboratories. He was a pilot plant shift supervisor at the laboratories.

John C. Johnston has been named division geologist and **William A. Matthews** has been made division geophysical supervisor for Stanolind at Casper, Wyoming.

Johnston succeeds **W. S. McCabe,** who recently was made division exploration superintendent. Johnston started with Stanolind in 1939. He worked in the Central division office in Oklhoma City and at Wichita, Kansas, before being named district geologist in Jackson, Mississippi, a year ago.

Matthews, who joined the company in 1936, has been at Houston, Texas, as assistant division seismograph supervisor for the Texas-Louisiana Gulf Coast division since March, 1946. Prior to that time, he was a seismograph interpreter in the Houston office.

Leonard L. Wootton, who was assigned to Stanolind's Fort Worth office has been transferred to the East Texas district, Longview, Texas.

Johnnie L. Cox has been transferred to the Panhandle district, Pampa, Texas. He also was formerly in the Fort Worth office.

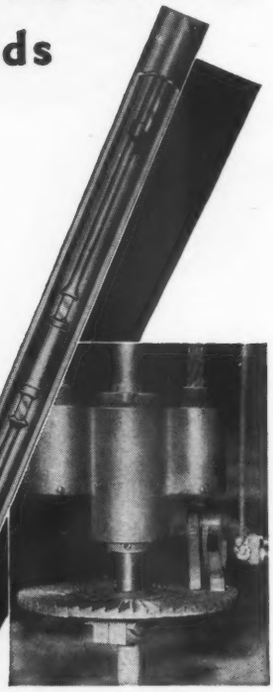
▸ **William W. Porter II,** head of Sunray Oil Corporation's West Coast land and geological department, is in charge of the company's Los Angeles office, recently expanded to handle foreign operations in Canada and the Near East. Porter has done consulting geological work in Canada, Central and South America, and the Philippines, as well as in the states. His services were retained by Sunray when the company's California offices were opened in March, 1947. The company's Four Deer field, Santa Barbara county, was discovered on land assembled by Porter and on drilling sites selected on his recommendation.

John O. Maberry, engineer-geologist, has joined the foreign operations department of Sunray as Porter's assistant in handling company operations on the West Coast and in Canada. Maberry was formerly with Shell and until recently with Gulf Oil Corporation. He was at one time rate and traffic counsel for the Corporation Commission of Oklahoma.

PARAFFIN'S NO PROBLEM

when your sucker rods are equipped with

HUBER SCRAPERS



Paraffin can't accumulate in the tubing when your sucker rods are equipped with Huber Scrapers. NO PARAFFIN . . . NO TROUBLE . . . NO REMOVAL COSTS!

Huber Scrapers, shrink-fitted to new or used sucker rods, scrape paraffin from the tubing wall as the string rotates and reciprocates. This constant scraping prevents paraffin accumulation . . . eliminates paraffin removal.

Huber Scrapers quickly pay for themselves. Wells requiring paraffin removal every week or ten days have been on production for months without paraffin trouble after Huber Scrapers were installed.

If paraffin's a problem, install Huber Scrapers. Write for descriptive bulletin.

HUBER ROTATING ROD HANGER

This rod hanger rotates the rod string a fraction of a turn on each reciprocation. The horizontal teeth on the turn table are engaged by two ratchet levers which are actuated by a flexible steel cable attached to the walking beam. On each reciprocation the levers move the rod string a fraction of a turn.

SOLD THROUGH SUPPLY STORES

J. M. HUBER CORPORATION
P. O. BOX 831 BORGER, TEXAS

HUBER PARAFFIN SCRAPERS

SCRAPE AS THEY ROTATE AS THEY RECIPROCATE

LEFT: A six-inch 10,000 p.s.i. test Otis Type XAS Surface Safety Valve manufactured for use on a 6" high-pressure gas injection line.

RIGHT: A two-inch 6000 p.s.i. test Otis Type XBD Surface Safety Valve equipped with both high and low-pressure pilots to operate on low pressure differentials.

Versatile VALVE

Dependable automatic flow line protection! That field-proven fact has firmly established the Otis Surface Safety Valve as a versatile piece of safety equipment adaptable to many different types of well, field, and plant installations.

You'll find these full-opening, pressure-operated, heavy-duty Valves on single and two-zone well connections, flow lines, transmission lines, gas injection lines, LPG systems, hot oil injection and return lines, etc., maintaining constant guard against dangerous pressure increases or drops — *and always ready to snap to a positive shut-off in the event a line breaks.*

Check the vulnerable points in *your* flow line systems. Then check the advantages of having this extra-added protection — *more dependable, more economical than personal supervision.*

Otis Surface Safety Valves consist of an Otis bonnet assembly and either a high-pressure or low-pressure spring-loaded pilot valve, or both, combined with a conventional heavy-duty gate valve body and gate. When line pressure increases or decreases beyond predetermined safety limits, either the high or low-pressure pilot snaps open, exhausts fluid or gas in the chamber beneath the piston to atmosphere, and automatically drives the gate valve down to a positive shut-off. Snap-action protection — the instant you need it!

Write Otis Pressure Control, Inc., Box 7206, Dallas, Texas, for complete details.

PRESSURE CONTROL - OTIS - SERVICE - EQUIPMENT

OTIS PRESSURE CONTROL, INC.

SURFACE SAFETY VALVE

(T-26)

FIELD OFFICES: TEXAS: HOUSTON, CORPUS CHRISTI, ODESSA, and LONGVIEW. OKLAHOMA: OKLAHOMA CITY. LOUISIANA: NEW IBERIA

OTIS ENGINEERING CORPORATION — MANUFACTURE AND DEVELOPMENT

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1 DIELECTRIC STRENGTH

The thickness of "TK-2" thermo-setting (baked-on) plastic coatings are accurately controlled for the maximum dielectric strength. In the above view a Tube-Kote inspector is gauging the coating thickness on sucker rods.

2 THOROUGH INSPECTION

With the use of recognized optical instruments internal surfaces of all tubular goods receive the most thorough and careful inspection to assure uniform cleanliness and proper base metal preparation.

3 RIGID PLANT CONTROL

Each and every phase of the Tube-Kote process, from the initial cleaning, through sandblasting, coating and baking in several steps is a matter of rigid plant control—thus assuring the highest degree of uniformity and quality.

4 AUTOMATIC EQUIPMENT

The Tube-Kote plant is equipped with many improvements in automatic mechanical facilities. Among these is the Tube-Kote fully automatic internal coating unit shown above, which applies a carefully controlled film in each coating operation.

TUBE-KOTE

First Name In Corrosion Resistance

2520 HOLMES ROAD . . . P. O. BOX 8123, HOUSTON, TEXAS

WIRE, PHONE OR WRITE FOR TUBE-KOTE TECHNICAL SERVICE BULLETIN

▸ **R. M. (Dick) White,** vice president of Franks Manufacturing Corporation, of Tulsa, who has spent 15 years in all phases of the firm's sales and service is moving to California to become exclusive California representative of Franks, announces Carl White, Jr., president.

Until he selects a permanent office location White will temporarily make his headquarters at the Franks service branch at 909 Alemeda Street, Compton, California.

▸ **J. H. Field** of the Sohio Petroleum Company, Oklahoma City, has been elected chairman of the Mid-Continent district, American Petroleum Institute Division of Production.

Other 1949-50 officers are:

Harold Berg, Tide Water Associated Oil Company, Tulsa, vice chairman for Oklahoma; **F. F. Kennedy,** Stanolind, Pampa, Texas, vice chairman for the Panhandle, and **W. R. Gottschall,** Continental Supply Company, Oklahoma City, secretary-treasurer.

▸ **R. W. Ard** has joined the field engineering staff of Technical Oil Tool Corporation, Ltd., and will work with

R. W. Ard

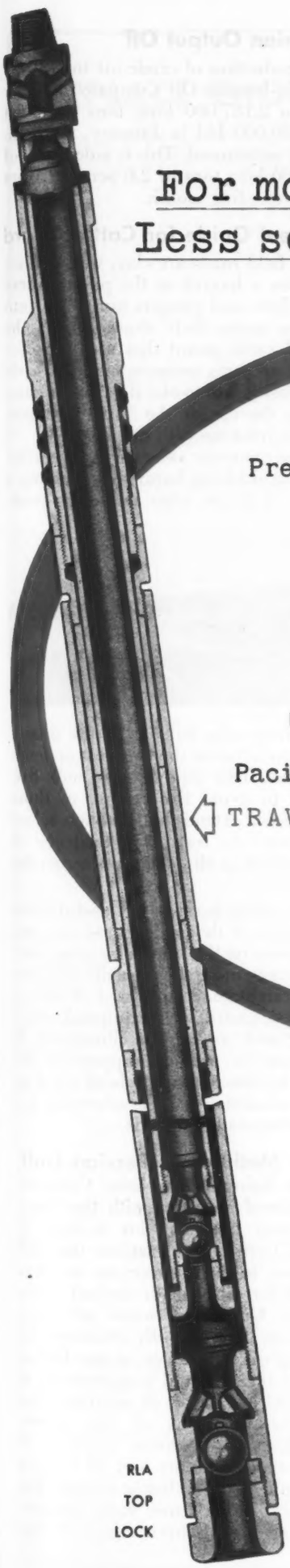
G. W. Ferguson

W. V. Oakes

L. M. Williford and **R. K. Palmer** in the Oklahoma and Kansas areas. At present, Ard is concentrating his efforts in the Lindsay field, south of his Oklahoma City headquarters.

G. W. Ferguson, Totco field engineer formerly at Lubbock, Texas, has been transferred to Abilene. **W. V. Oakes,** who recently joined the company, will work under **F. E. Siever** in the West Texas and New Mexico district, headquartering in Lubbock, Texas.

For more service in your well...
Less servicing at the surface!



Specify Pacific
Precision Built Oil Well Plunger Pumps

Require Less Servicing at the Surface Because
of Maximum Protection for the Critical Zone
By Selecting Materials for

Plungers · Liners · Valves
Valve Seats · Valve Cages

To resist corrosion and finished with the
hardness necessary TO RESIST ABRASION AND WEAR.

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Built to API Standards
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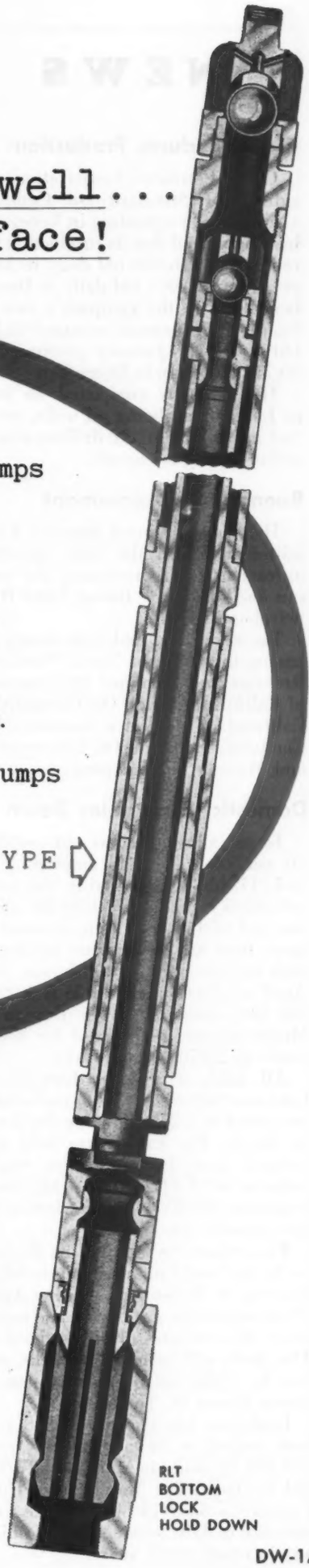


RLA
TOP
LOCK

RLT
BOTTOM
LOCK
HOLD DOWN

DW-1A

NEWS

Creole Reduces Production

Creole Petroleum Corporation, subsidiary of Standard Oil Company (New Jersey) operating in Venezuela, has announced that its production was reduced to 516,580 bbl daily in January from 610,961 bbl daily in December. Runs to the company's two refineries in Venezuela averaged 61,113 bbl a day in January compared to 60,742 bbl daily in December.

The company completed 16 wells in January, all being oil wells, and it had an average of 31 drilling rigs in action during the month.

Buena Vista Agreement

The House Armed Services Committee approved the unit operating agreement for repressuring the western end of Navy's Buena Vista Hills petroleum reserve.

The agreement had been drawn up among the Office of Naval Petroleum Reserves and Standard Oil Company of California, Union Oil Company of California, Tide Water Associated Oil Company, Honolulu Oil Corporation, and Murvale Oil Company.

Domestic Allowables Down

Texas' allowable was cut another 10 per cent April 1, amounting to 234,211 bbl and bringing the total reduction to about 750,000 bbl since the end of the year. This amount is more than any other state produces, with the exception of California. The April production allowable is 1,994,360 bbl, compared to the Bureau of Mines estimate of demand for Texas crude of 2,370,000 bbl daily.

All fields except the East Texas field were placed on a 19-day schedule, compared to a 23-producing day basis in March. The East Texas field was reduced from 19 to 17 days. Sharp reductions of 81,266 bbl daily were registered for West Texas, where storage capacity was filled.

The reductions may not be the last as the Railroad Commission is holding hearings in Houston, beginning April 19, to reconsider gas flaring and maximum efficient rates of oil production. The study will be made by wells, not just by fields, according to Commissioner Ernest O. Thompson.

Louisiana has also ordered its second reduction in allowables, from 534,000 bbl daily in March to 527,000 bbl in April. The March drop, from February's 553,974 bbl, was the first decrease in daily production in Louisiana in nearly three years.

Plant to Be Enlarged

The Texas Company has announced plans to add three 600-hp compressors to the Magnet-Withers plant, increasing the daily capacity by 9,000,000 cu ft. The unit will compress low pressure gas for several operators in the field and make it available for gas lift purposes or for resale.

Tellepsen Construction Company has been awarded the contract to install the new equipment.

Diamond Chain Distributors

In order to make its roller chain, sprockets, and flexible couplings more widely available from stock, Diamond Chain Company of Indianapolis has widened its countrywide coverage with a number of additional firms appointed as distributors. Among these are: Century Supply and Equipment Company, Akron, Ohio; Hines Bearing and Industrial Supply, Billings, Montana; The Ross-Willoughby Company, Columbus, Ohio; Ralph Shawaker Company, Toledo, Ohio; Joseph E. Loughead Company, Kalamazoo, Michigan; J. W. Vaughn Company, Greenville, South Carolina; Crossley Company, Erie, Pennsylvania; The Mine and Smelter Supply Company, El Paso, Texas; The Harry Cornelius Company, Albuquerque, New Mexico; Apex Power Equipment Company and Ray M. Ring Company, Chicago; and W. F. McGraw and Company, Detroit, Michigan.

Magnolia Fellowships

Magnolia Petroleum Company has established a fellowship in physical chemistry at the University of Texas. Other Magnolia-sponsored fellowships are at the University of Oklahoma in chemical engineering and at Rice Institute in physics.

Fellowships are awarded annually and carry a stipend of $2,000.00 each. Recipients of the fellowships are selected by the university from among students with at least one year of graduate work. No restrictions are placed on those selected as to future employment nor as to publication of results of their investigations.

In addition to this program, an educational grant is made annually to an outstanding technical employe selected from some one of the company's laboratories. One of these laboratories devoted to exploration and production research is located at Dallas, Texas, and two of the men from this Magnolia laboratory are at the present time enjoying such educational grants. These grants provide full pay to the successful candidate for such time as is necessary for the attainment of a Doctor's Degree at an accredited school of the candidate's choice.

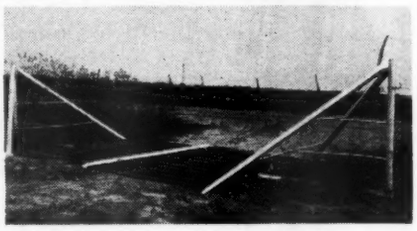
Iranian Output Off

Production of crude oil in Iran by Anglo-Iranian Oil Company amounted to 2,187,000 long tons or about 16,850,000 bbl in January, the company announced. This is a decrease of 57,000 long tons or 2.6 per cent from the preceding month.

Wheel Guide for Cattle Guard

If field roads are clay, wet weather creates a hazard at the points where switchers and gaugers must turn into leases under their charge. With the usual cattle guard that uses pipe for the supporting surfaces, muddy wheels can easily skid to one side, either damaging the car or the flared structure which joins up with the fence.

One company safeguards its entries against skidding hazards by welding a piece of 2½-in. pipe across the road-



way from edge to edge of the guard, midway between the two post or fence sections. This pipe has its ends flattened to avoid tire cutting at those points, but extends high enough across the guard to resist any tendency of the vehicle to slip sideways across the pipe.

The guide is especially useful when the pipes of the cattle guard are wet, dampness on the transverse pipe making it even more than usually effective for straightening out a skid. Width of the cattle guard, when equipped with a guide such as the one illustrated, is sufficient to provide support in the clear for the outer wheels of a car or truck when those on the other side are in contact with the guide.

New Methods in Persian Gulf

The Bahrein Petroleum Company has placed an order with the Decca Navigator Company for a chain of Decca transmitting stations that will be used to help surveyors in their search for oil beneath the bed of the Persian Gulf. Underwater oil operations are being rapidly developed by leading oil companies, states Decca; one of the essential requirements in this field is a means of accurately fixing the positions of the survey launches. The Bahrein company is understood to be the first oil concern to employ the Navigator system. The contract is for three radio stations covering the Bahrein area of the Gulf.

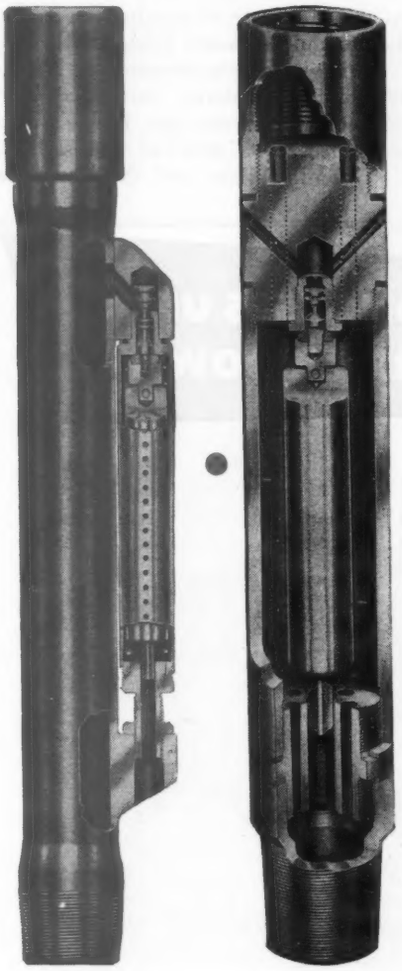
REPLACE THOSE JET COLLARS WITH . . .

NIXON "WEIGHT-LOADED" GAS LIFT FLOW VALVES

—Save Input Gas . . . Increase Production

for Tubing Flow

For medium and high Producing Fluid Level Wells, where the amount of fluid to be produced does not exceed the capacity of the tubing — Nixon "Weight Loaded" Gas Lift Tubing Flow Valves are recommended. (shown at right)



(Pat. Pending)

(Pat. Pending)

for Casing Flow

When wells are located in heavy water drive fields, where it is necessary to produce more fluid than can be handled thru the tubing, Nixon "Weight Loaded" Gas Lift Casing Flow Valves really do the job. (shown at left)

Operators who have wells now producing thru Jet Collars with a high gas-oil ratio, will welcome the new Nixon "Weight Loaded" Gas Lift Flow Valves—for every well in which they have been run—input gas volume has been reduced to a great extent.

In many instances a major increase in production has occurred.

These new valves are simple in design and have no parts which fail thru fatigue. They remain in calibration throughout their long life. Can be completely serviced in the field.

If you are interested in these NEW "Weight Loaded" Differential Gas Lift Flow Valves—write for complete information contained in a 24-page illustrated booklet giving installation and operating data. Address:

WILSON SUPPLY COMPANY, GAS LIFT DEPARTMENT

P. O. Drawer 19, Houston, Texas, or contact your nearest Wilson Supply Store.

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Flys to Bolivia

E. E. Childress, chief engineer of Stewart and Stevenson Services of Houston, has set what his company believes to be some sort of record in a service trip. He flew 4847 miles to Bolivia to check diesel installations sold to companies operating in that country by Stewart and Stevenson.

"When we sold these installations," said Joe Manning, vice president and sales manager, "we told the purchasers they'd get the usual Stewart and Stevenson service. So sending Childress to Bolivia is just carrying out that promise."

Canada's Oil Output 77% More Than Year Ago

Canada's Bureau of Statistics has reported that production of crude oil and natural gasoline reached 1,356,500 bbl in January. This output was 9 per cent higher than the preceding month and 77 per cent above January last year. The rise was primarily due to the high rate of production in the Leduc and Redwater fields of Alberta.

This province accounted for 1,280,000 bbl in January, compared with 687,400 bbl a year ago. Leduc's production was 707,400 bbl against 122,300 bbl last year, and the Redwater field, which had not been discovered a year earlier, added 68,400 bbl to Alberta's output. Lloydminster was up to 46,500 bbl from 35,500 and Turner Valley decreased to 355,800 bbl from 425,100 in January a year earlier.

Riley Expands His Company

John R. Riley, president of the Big Four Machine and Supply Company, Clay City, Illinois, has announced the purchase of the Murray Tool and Supply Company shop at Pawhuska, Oklahoma. The newly acquired shop will continue the repair of oil field equipment and will also manufacture portable drilling rigs, goosenecks, drill pipe floats, hydraulic wall hooks, slim hole swivels, and other products now produced at the Clay City plant.

John R. Riley

Riley became acquainted with the oil industry by helping his father maintain a livery stable in Nowata during the "horse and buggy" days when oil was first discovered around Nowata and Alluwe, Oklahoma in 1903. In 1920 he joined Oil Well Supply at Pawhuska and was later with American Iron and Machine Works.

Secondary Recovery Studies

The Bureau of Mines oil field laboratory at San Francisco has completed studies of the gravitational drainage of oil, and Report No. 4391 describing the findings is available from the Pittsburgh, Pennsylvania, office.

After observing simulated primary production of heavy oil that had been introduced into the "oil sand" of the laboratory, an air drive to force the oil to the bore was tested. The sand then was heated electrically to reduce the viscosity of the oil. Neither of these methods resulted in an appreciable increase in oil recovery. Application of heat caused caking of sand around the heating tunnel.

Keystone Plant in Houston

Keystone Tool Corporation, founded and managed by C. K. Stillwagon, is now delivering its own manufactured products out of Houston, Texas. In addition to manufacturing its own products, Keystone represents the Hamer Oil Tool Company of Long Beach, California, handling Hamers' well established line of plug valve and line blinds.

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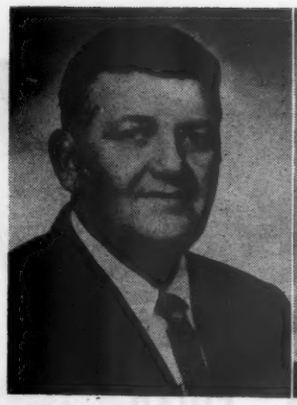
Wild Canadian Well

Stanolind Oil and Gas Company has a wild gas well about 110 miles northeast of Edmonton, Alberta. This well, the No. 1 Lac la Biche, had reached 1586 ft in porous lime when mud was lost and the well blew out of control; it cratered badly about the center. The flow of the well has been estimated at 20,000,000 cu ft daily.

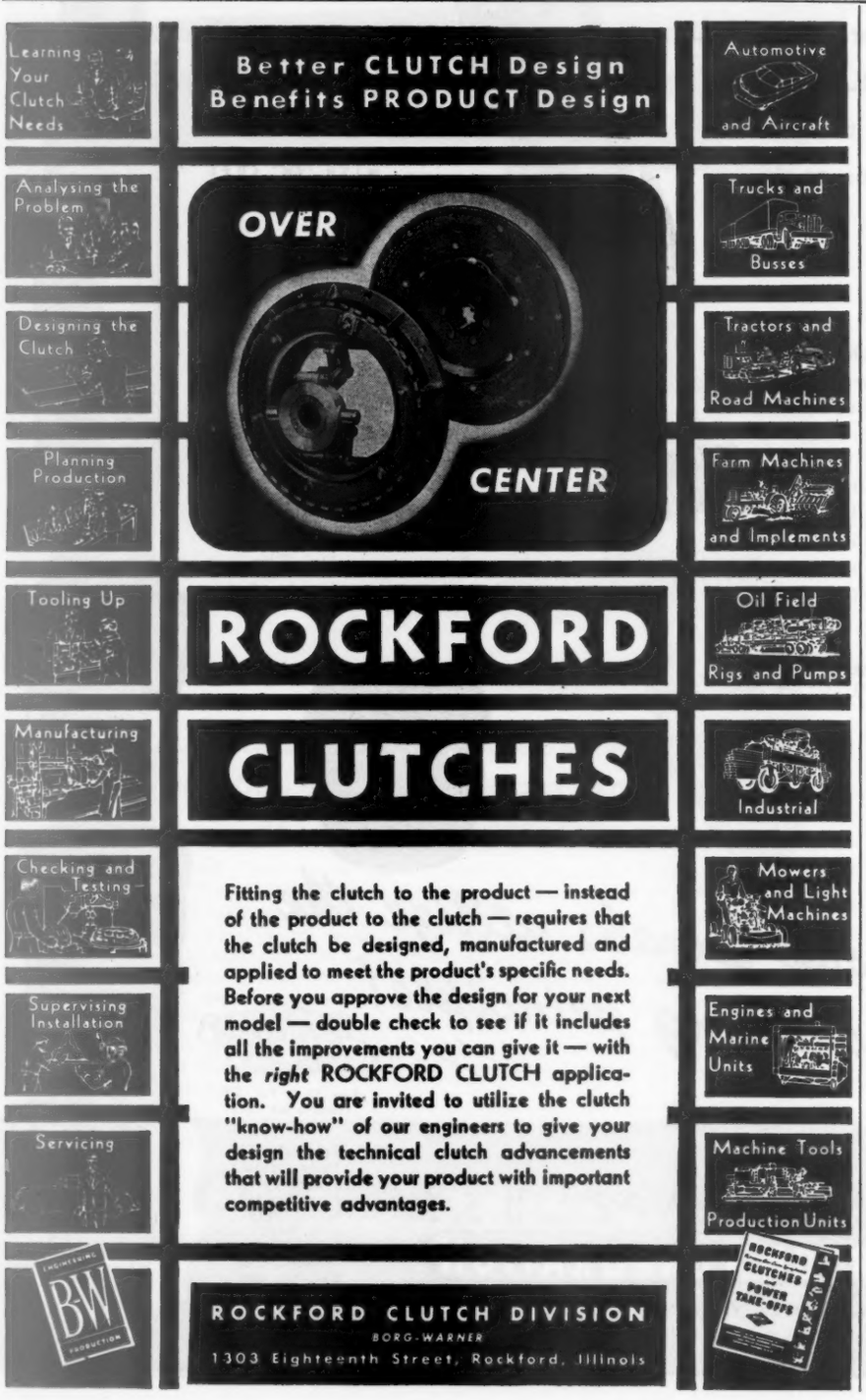
Stanolind was preparing to drill a relief well to bring the wild well under control. Last year another even larger rogue well, Atlantic No. 3, ran wild for six months, pouring out some 1,200,000 bbl of crude before two relief wells harnessed it.



Elmer R. Tieberman
Dallas, Texas

D. R. Davis
Tulsa, Oklahoma

William A. Boles
Wichita Falls, Texas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Changes in Territory

The Lunkenheimer Company, manufacturer of bronze, iron and steel valves, announces transfer in territorial representatives, as follows: Elmer R. Tieberman, Lunkenheimer representative, who for many years handled the oil field sales territory embracing Oklahoma and Kansas, with headquarters in Tulsa, has transferred to Dallas, Texas, covering northeastern Texas, northern Louisiana, and part of Arkansas.

Duffie "Dave" Davis, well-known as a Lunkenheimer representative, succeeds Tieberman at Tulsa. Davis formerly worked out of Wichita Falls, covering West Texas. William A. Boles, Wichita Falls, recently joined the company and will take over the territory formerly handled by Davis.

Marshall Stickel and Joe Birkhead, long associated with Lunkenheimer as representatives in the Mid-Continent and Gulf Coast districts, will continue to maintain their headquarters at Houston. Jos. Waldeck, widely-known veteran Lunkenheimer representative, will confine his activities to parts of Missouri and southeastern Illinois, with headquarters at St. Louis.

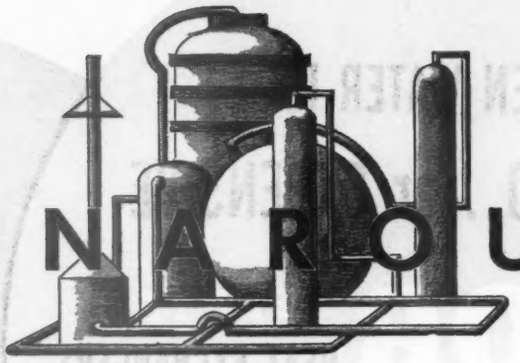
TIPRO Meets in Houston

The newly-opened Shamrock Hotel in Houston, Texas, was the scene of the third annual meeting of the Texas Independent Producers and Royalty Owners Association, April 1 and 2. The association was organized three years ago to promote the interest and general welfare of the Texas independent oil producers and royalty owners of oil, gas, and other mineral rights. The association embraces a membership of nearly 4000.

Officers are Guy I. Warren, president; E. I. Thompson, vice president; A. R. McElreath, secretary; and William T. Beard, treasurer.

Walter Hallanan, president of the Plymouth Oil Company of Pittsburgh, Pennsylvania, was the principal speaker at the annual dinner.

THE TURNAROUND



Trainers' Colleges Needed by Refining Industry?

THE training of supervisors in industry, says H. D. Kolb, chairman of the API Committee on Training in Refining, is widely acknowledged as the first line of attack on virtually all problems of efficiency, morale, harmony, and even problems of training (in refining). After surveying the activities of 144 refining plants of different capacities, this group discovers that less than half the 5000-20,000 bbl per day refineries unaffiliated with larger companies or plants have any systematic training program whatever.

The conclusions of the survey committee include the apparent fact that one of the greatest problems is that of "training the trainers." In one section of this country advances have been made by the organization, by the trainers themselves, of a regional committee for the express purpose of holding conferences periodically to discuss training techniques. In at least one case a series of lectures by prominent engineering and scientific educators have been presented by an individual company, to which selected members of the company's technical staff were assigned for attendance. Training institutes sponsored by colleges and universities were held to help train staff members.

While training in refineries is expanding, the survey showed that relatively little is being done in the smaller unaffiliated companies to give additional training to employes. Say the investigators, "The availability of fully qualified candidates for employment in the smaller plants reduces training needs accordingly." Nevertheless, that training must be obtained from somewhere, and doubtless that "somewhere" is, in part, in the training programs of the larger plants.

Scanning the details of the report: In 87 refineries studied, of less than 20,000 bbl per day capacity, only "two to five" are doing organized process training; one-third of the plants above that capacity are training employes specially in operations of their own units. One-fifth of the smaller refineries are training supervisors in union contracts and human relations; only one-tenth are being given job instruction. Among refineries rated arbitrarily as Class A (50,000 bbl a day or more) 100 per cent are conducting some type of training, with one trainer for each 912 employes; Class B plants (21,000-50,000 bbl a day) 80 per cent are training their men, with one instructor for each 1425 persons. Large-company affiliated small plants (5000-20,000 bbl a day) are training employes to the extent of 71 per cent of units with one trainer for nearly 3700 men; independent small refineries have no training staffs, but 40 per cent are giving some type of training.

Many plant executives feel that the need for training is present; they excuse inaction or inadequate programs on the grounds of either lack of knowledge of proper training techniques or a lack of training manpower. Particularly in a cost-reduction atmosphere can training prove its worth, the surveyors say in conclusion. The whole problem constitutes a challenge; if the training techniques are sound the results should so far outweigh cost that refiners can ill afford not to provide training.

The highly specialized nature of refinery operation a la 1949 makes highly specialized training indispensable to the organization that would survive.—ALF.

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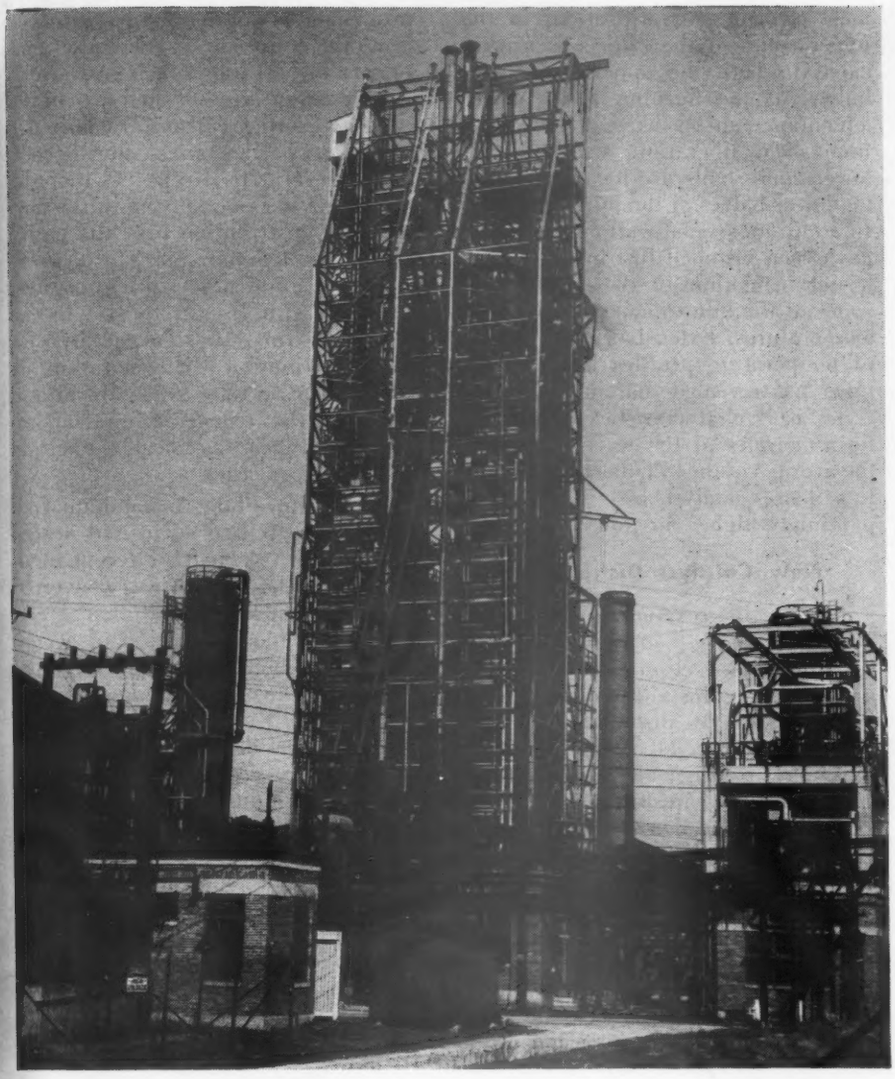
P 721.33



View of the Ashland TCC unit, revamped recently to increase its gasoline yield by more than 50 per cent, octane rating by 2-3 numbers.

Ashland Modernizes Wartime TCC Unit

A. W. HOGE* and WILLIAM TIERNAN†

Abstract. Boosting the gasoline yield from 42 per cent to 57-plus per cent of the charge; increasing furnace oil yield from 16 per cent to 25.5 per cent of charge, are some of the advantages obtained by Ashland Oil and Refining Company by modernizing its TCC unit, one of the oldest of its type, built during the war. This modernization consisted mainly of adding two burning zones to the regenerator, converting the reactor to concurrent instead of the older countercurrent flow of catalyst and charge vapor, and revising some of the internal reactor equipment such as the vapor-catalyst disengaging mechanism. Project required 44,000 manhours.

*Technical Service Engineer, Houdry Process Corporation.
†Project Engineer, Catalytic Construction Company.

EXCLUSIVE

ASHLAND OIL AND REFINING COMPANY has just completed the modernization of one of its two TCC units at its Catlettsburg, Kentucky refinery. These units are part of an aviation gas plant built by the Defense Plant Corporation in 1943.

In order to maintain continuous production of catalytic gasoline, Ashland decided to rehabilitate the cracking section while continuing to operate the treater plant until the rebuilt unit was ready to go on stream. The modernization program, as carried out by Catalytic Construction Company, has increased the capacity of the regenerator by an estimated 40 per cent. This increase in kiln capacity allows either an increased charge rate to the cracking unit or increased severity of cracking at the same charge rate. The contract included the engineering, purchasing, and field construction work for the entire modernization program.

The TCC unit originally consisted of a counter current reactor and an eight zone kiln, the capacity of which was not sufficient to permit Ashland's present production demands. In order to realize the maximum possibilities of the TCC unit two new burning zones were installed in the kiln, thus increasing its overall height by 20 ft. The reactor was converted to the latest concurrent cup-type design of the Houdry Process Corporation.

The dismantling of the kiln was accomplished in twenty shifts, and so scheduled that its completion would coincide with the arrival of the new internal parts. The removal of the old internals and the installation was expedited by the erection of a high-speed material hoist between the kilns of the twin units. A major saving in time and labor was effected by the raising of the top of the kiln so that the new section could be installed; the original scope of work called for the removal of the top of the kiln to the ground. For this installation a store house and tool room was constructed about midway of the structure, which made tools and supplies more accessible.

All columns and beams in the existing structure were utilized to the fullest so that the new parts of the extension consisted mainly of additional platforms for operating accessibility.

Ashland's No. 2 unit, which is built within the same structure as the modernized unit, was built originally with a 10-zone kiln. The improvements to No. 1 unit, while radically different inside, gave an outside appearance identical with the adjacent unit.

The rebuilding of the kiln required 95 shifts; work on the reactor, which required 35 shifts, was started at a time which allowed for its completion to coincide with that of the kiln work. The total project consumed 44,000 manhours, or 8500 manhours less than the estimated figures.

In comparing the original design of the Ashland TCC unit with modern standards, it was evident that most of the improvements to be effected would be in the kiln or regenerator. This was an eight-zone kiln and of the earliest angle-packed or cartridge type. Its modernization included the addition of two or more regeneration zones and a complete rebuilding of the internals to modern solid-bed design. Also, the original internal kiln insulation was completely replaced with a suspended-tile type of insulation, which has given excellent service for many years on more modern TCC units. Externally very few changes on the kiln were required excepting the revisions at the top of the structure necessary to accommodate the additional regeneration zones.

Carbon Capacity Up 40%

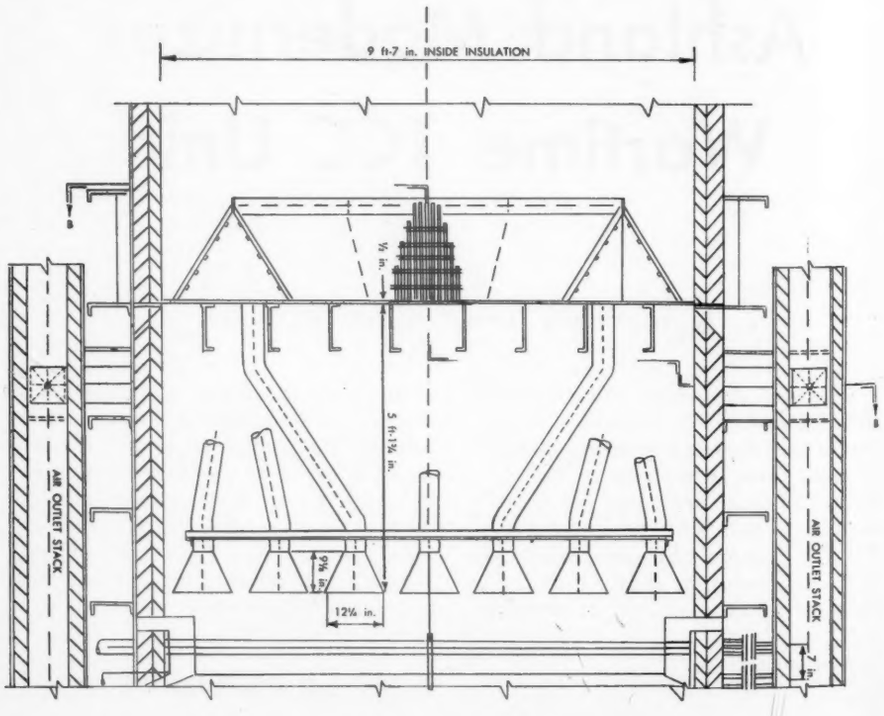
It may be estimated conservatively that the modernization of the kiln will increase its carbon burning capacity by 40 per cent. This increase results not only from the change to solid-bed design but also from the incorporation of several devices which contribute to the achievement of uniform patterns of catalyst flow, air flow, and temperature over the kiln cross-sectional area. One of the major factors in kiln carbon burning rate is catalyst residence time. So far as this factor alone is concerned, the conversion from angle-packed to solid-bed kiln results in an increase of about 75 per cent in catalyst residence time. It is obvious, however, that if regenerator temperatures are to be maintained at a desirably low level carbon burning rates cannot be increased unless heat removal capacity is correspondingly increased. Consequently, the modernized Ashland kiln has been equipped with many additional cooling coils through which boiler feed water is circulated for heat removal. These coils are installed in the burning zones with air or flue gas passing through the banks of coils along with the catalyst. Experience has demonstrated that this arrangement provides the most efficient coil utilization. In the upper zones of the kiln coils are located in both the upper and lower halves of the burning zones where advantage can be taken of the maximum heat liberation, while in the lower zones coils are located only in the lower halves of the burning zones. In addition, special wall cooling coils have been installed just inside the internal insulation in the upper four zones of the kiln to control peak wall temperatures. Extensive investigation of temperature profiles in solid-bed kilns has revealed that in the upper zones it is characteristic for carbon burning rates at the walls to exceed the average of the kiln due to a slightly less dense catalyst bed and correspondingly higher air flow rates.

New Catalyst Distributor

A major improvement in the distribution of catalyst and air flow over the kiln cross-sectional area was effected by the installation of a new type of catalyst distributor in the kiln hopper (Fig. 1). This distributor is simple in design and yet effective, as demonstrated in other commercial TCC units as well as in scale-model experiments. Briefly, the distributor consists of 49 catalyst feed pipes attached to the top seal plate, which forms the bottom of the kiln hopper, in a circular pattern concentric with the center line of the kiln. The 49 feed pipes are offset and so oriented that the pipes discharge into the kiln proper on a square-pitch pattern covering the entire kiln cross-section uniformly on a 17-in. spacing. The circular configuration of the pipes in the seal plate insures a uniform mixture of catalyst particle sizes entering each of the several feed pipes so that the net result is essentially uniform particle size distribution over the entire kiln cross-sectional area. The achievement of a uniform mixture of catalyst particles with respect to size in the solid-bed kiln results in equally uniform distribution of regeneration air so that buring rates are uniform and consequently regeneration temperatures approach the ideal isothermal pattern across each zone.

The reactor of the Ashland unit had been converted to solid-bed design previously. As a part of recent modernization, the reactor was converted to concurrent flow of oil charge and catalyst by the installation of a cup-type vapor-catalyst disengager and the reversal of the oil inlet and outlet lines (Fig. 2). Previously published articles have described the decided advantage of concurent flow on the older TCC units operating with a catalyst-to-oil ratio in the range of 1.5-2.5 V/V. On such units the heat content of the inlet catalyst stream contributes to the average reactor temperature on concurent flow, whereas on countercurrent flow the differential heat content of the inlet catalyst stream above average reactor temperature is absorbed by the effluent

FIG. 1. Drawing of new type catalyst distributor installed in regenerator kiln.



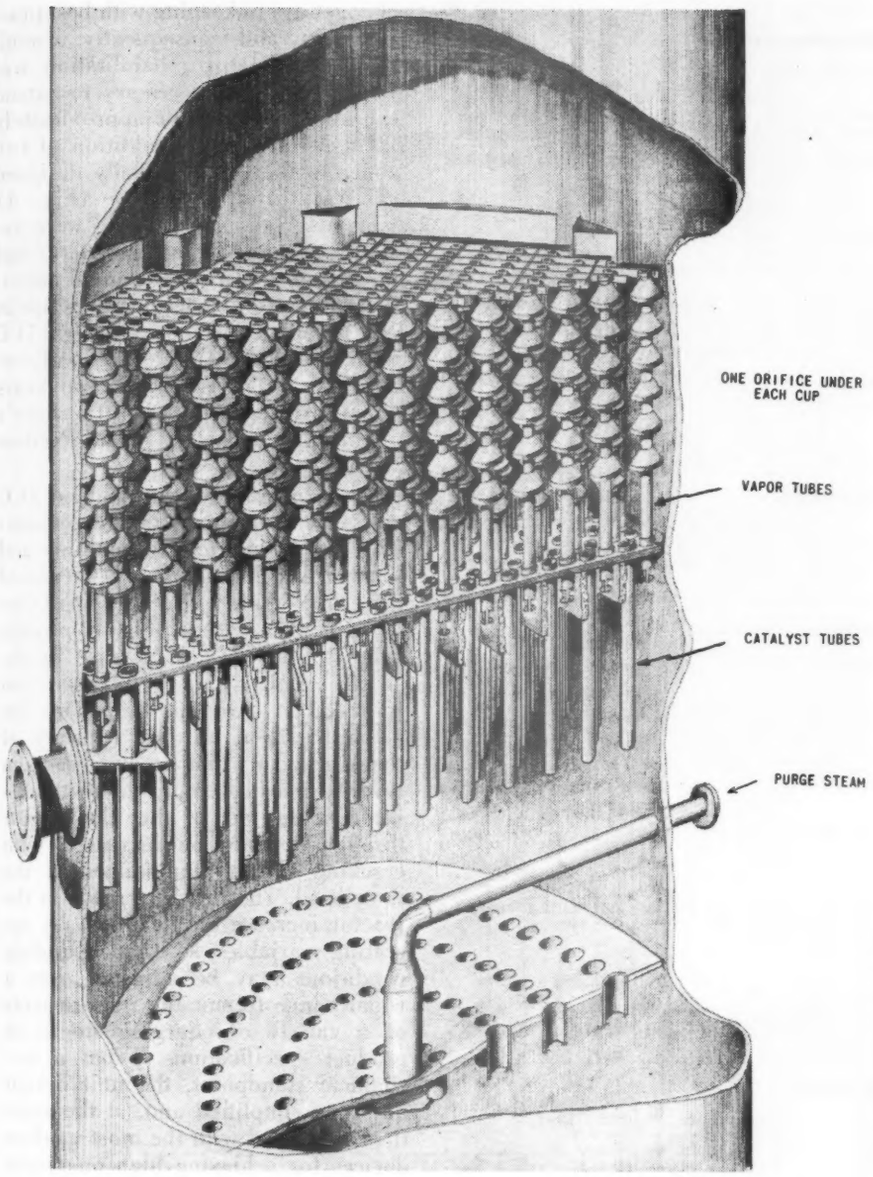


FIG. 2. Cut-type vapor-catalyst disengager installed in the TCC reactor.

vapors at the top of the reactor and thus cannot be utilized in the cracking zone. On the average, the conversion from countercurrent to concurrent flow on a unit of this type results in an increase in average reactor temperature of about 50 F. The availability of higher reaction temperatures can be utilized not only to increase the gasoline yield but also to improve gasoline anti-knock quality to the extent of about two numbers, Motor Method, clear, and three numbers, Research Method, clear.

Preparations have also been made for processing sour stocks, such as those derived from Middle Eastern crudes, in the TCC unit. The shell of the reactor has been lined internally with 12 per cent chrome and the catalyst-vapor disengager has likewise been fabricated from 12 per cent chrome for protection against corrosive stocks. Moreover, provision has been made for prehydrating the natural clay catalyst and using a steam seal in the top of the reactor in order to protect the catalyst against abnormal deactivation if and when sour stocks are processed. It has been demonstrated both in the laboratory and on commercial units during the past several years that the practice of hydrating natural clay catalyst prior to its entering the reactor, to a very great degree, will minimize the otherwise deleterious effect of high sulphur stocks on natural clay catalyst.

Use Chopper Valves

The two hot catalyst elevators on this unit had been modernized to some extent prior to the shutdown of the unit in 1946. Traction rims had been installed on the head shaft to replace the original sprocket wheels and a portion of the internal insulation had been sheathed with metal liner plate as a protection against erosion of the insulation (Fig. 3). Both of these

FIG. 3. Elevator head shaft and its traction rim drive revamped for better operating results.

FIG. 4. Modern chopper valve layout, which replaced the old butterfly type in the Ashland TCC unit.

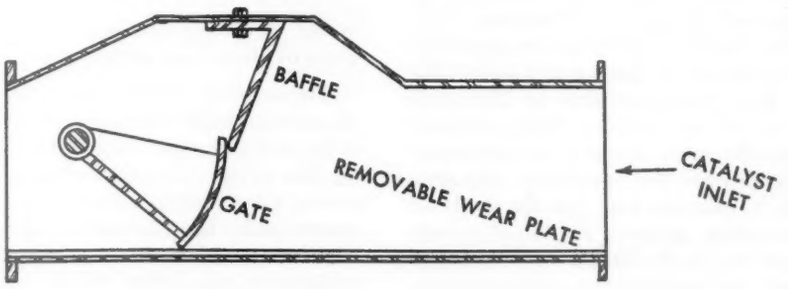


TABLE 1. TCC operating summary.

August 1945, Countercurrent Flow

	BPSD	Lb per hour	Per cent virgin reactor chg. Vol. %	Per cent virgin reactor chg. Wt. %	Gr. °API	ASTM distillations, °F. IBP	10%	50%	90%	EP	RVP	Clear octane No. MM.	Clear octane No. Res.
CHARGE													
Reduced crude	11,507	150,120			26.5								
Tar separator btms.	3,029	42,150			16.5	514	805	850°@16% (Vac. Dist.)					
Virgin reactor chg.	8,478	107,970	100.0	100.0	30.5								
Recycle	986	12,620			29.5								
Total reactor	9,464	120,590			30.5	455	590	766	944°@82% (Vac. Dist.)				
PRODUCTS													
Debut. gasoline (388°F./90%)	3,574	39,500	42.1	36.6	55.0	98	111	250	388	424	5	78.5	88.5
Furnace oil	1,353	17,090	16.0	15.8	32.0	459	472	500	577	648			
Cycle gas oil	2,468	31,450	29.2	29.2	29.0	470	520	588	670	700°@98%			
Synthetic tower btms.	225	3,120	2.7	2.9	17.5	590	692						
Total C_4 fraction	770	6,600	9.1	6.1									
C_4 plus liquid recovery	8,391		99.1										
C_3 fraction		2,826		2.6									
Dry gas		2,611		2.4									
Carbon		3,350		3.1									
Total		106,547		98.7									

Principal Operating Conditions

Temperature vapors to reactor	— 870 F.	Space velocity	— 1.01 V/Hr/V
Temperature catalyst to reactor	— 880 F.	Cat/oil ratio	— 2.0 V/V
Process steam	— 1.7 Wt. % total reactor charge	Type catalyst	— Natural clay
		CAT-A activity	— 30 A. I.

TABLE 2. TCC operating summary.

November 1948, Concurrent Flow

	BPSD	Lb per hour	Per cent virgin reactor chg. Vol. %	Per cent virgin reactor chg. Wt. %	Gr. °API	ASTM distillations, °F. IBP	10%	50%	90%	EP	RVP	Clear octane No. MM.	Clear octane No. Res.
CHARGE													
Reduced crude	10,725	139,100			27.6								
Tar separator btms.	2,086	29,000			17.0								
Virgin reactor charge	8,639	110,100	100.0	100.0	30.0								
Recycle	900	11,520			29.5								
Total reactor charge	9,539	121,620			29.9								
PRODUCTS													
Gasoline (12# RVP, 391°/90%)	4,948	53,000	57.3	48.1	60.6	91	111	202	391	434	12.1	79.8	91.1
Furnace oil	2,203	28,030	25.5	25.4	30.5	473			600	640			
Synthetic tower btms.	541	7,160	6.3	6.5	24.4								
Excess C_4 fraction	921	7,900	10.7	7.2									
C_4 plus liquid recovery	8,613		99.8										
C_3 fraction	637	4,680		4.2									
Dry gas		4,400		4.0									
Carbon		4,200		3.8									
Total		109,370		99.2									

Principal Operating Conditions

Temperature vapors to reactor	— 910 F.	Space velocity	— 1.35 V/Hr/V
Temperature catalyst to reactor	— 940 F.	Cat/oil ratio	— 2.3 V/V
Process steam	— 3.3 Wt. % total reactor charge	Type catalyst	— Natural clay
		CAT-A activity	— 32 A. I.

changes are in keeping with best practice today and, consequently, a minimum of elevator rehabilitation was required. It was necessary to extend the kiln feed elevator approximately 20 ft because of the addition of two zones to the kiln. Specially designed catalyst throttling valves (Fig. 4) known as chopper valves, were installed at the outlet of the reactor and the kiln to replace the original butterfly type valves. Chopper valves are in use on all of the more modern TCC units, and their trouble-free performance over a period of several years substantiates the manufacturer's claims for positive action and freedom from erosion.

Modernization of the Ashland TCC unit can be justified on five counts: (1) improved product qualities and yields (Tables 1 and 2), (2) increased flexibility and serviceability of the equipment, (3) the ability to process sour stocks, (4) an increase in on-stream efficiency, and (5) reduction in catalyst consumption. The increased carbon burning capacity of the kiln means that greater cracking severity may be employed in the reactor, if desired, or that the reactor throughput may be increased with cracking severity maintained at the same level. The revisions made in the reactor increase the flexibility in operating variables so that operating conditions may be adjusted over a wider range to suit the requirements of a variety of charging stocks or product specifications. From a mechanical standpoint, the unit design has been simplified and, at the same time, equipped with the most modern devices for achieving high on-stream efficiency. ★ ★ ★

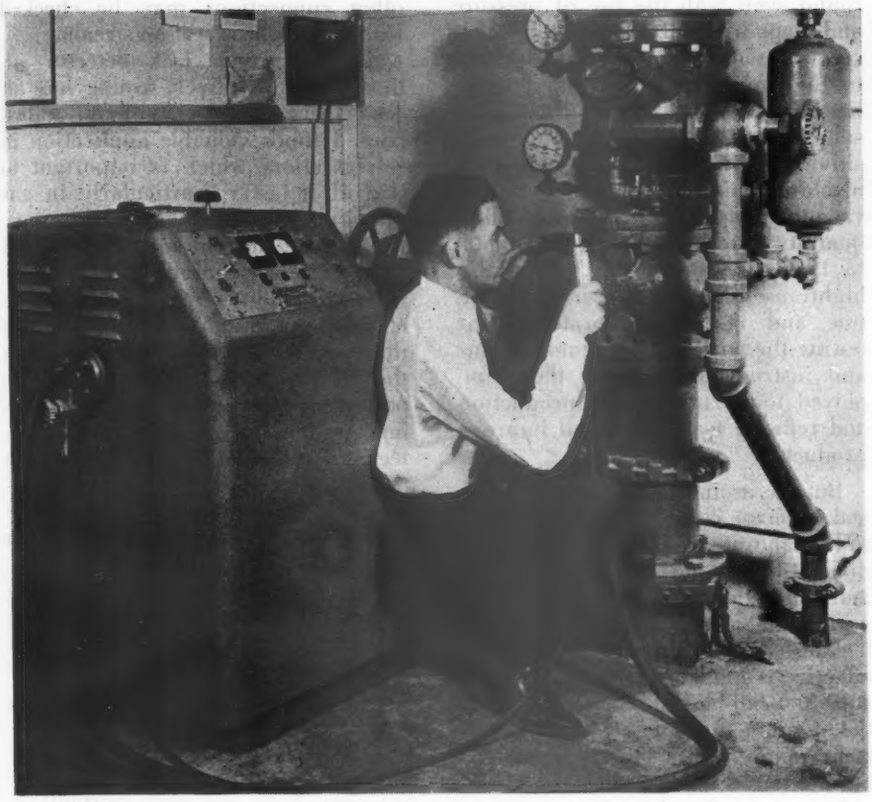
P 206.8

Worker Consistometer Used for Study of Lubricating Greases

Recent investigations of the effect of mechanical working on the physical properties of lubricating greases by S. A. McKee and H. S. White of the National Bureau of Standards have led to the development of an apparatus for working the grease and measuring its flow characteristics in the same series of operations. Data obtained with the new worker consistometer indicate that the apparatus may provide a valuable tool for the study of lubricating greases. Principal advantages are its flexibility, wide range of shear and consistency measurements, short test cycle, simplicity of design, and, in particular, its provision for characteristic flow data while working under controlled conditions. In addition to the application to greases, Bureau engineers have used the apparatus to determine the apparent viscosity of rubber solutions at different rates of shear and temperature.

The worker consistometer is composed essentially of two coaxial steel cylinders mounted vertically with a capillary-type shearing element between. Close-fitting pistons force the grease under test through the shearing element in either direction from one cylinder to the other. While making flow measurements, dead weights are used on the down-stroke of the pistons and air pressure on the up-stroke. Provision is also made for automatic mechanical working.

Various shearing elements can be used and are made by drilling holes (No. 79 drill) in circular steel disks ¼ in. thick, giving capillaries ¼ in. long and about 0.015 in. in diam. In order to cover a range of consistencies, one element has one hole, a second has 10, and a third, 50 holes. An important advantage is offered by these disks that provide elements with different multiples of the same size capillaries for all grades of greases. This eliminates the effect of different capillary dimensions in the comparison of non-Newtonian greases of different consistencies.



Here the operator is demonstrating the manner of using the "sniffer" on a gas line flange. Helium is injected into the pipe line and wherever a leak occurs, its presence is indicated, both audibly and visually.

Electronic Leak Detection

By RICHARD SNEDDEN*

OUR increasing ability to measure hitherto indeterminable quantities, qualities, and effects, is a providential circumstance that has already been responsible for spectacular advances on all scientific fronts, and is certain to carry the future of industrial research to exciting new frontiers. One of the results of this trend is that certain physical, chemical and electrical phenomena have in recent years been found to be much more closely interrelated than was formerly thought possible, and they have actually been yoked together to accomplish most amazing results in laboratories and plants of widely diverse industries. In analytical and research laboratories, many of the so-called wet methods have been abandoned in favor of electronic and other modernized devices that are practically automatic in action, and at the same time are extremely accurate.

In the main these new analytical instruments are the result of comparatively recent forays into the realm of the infinitesimal, that for so long has defied invasion. They are the products of a new-found capacity to resolve small quantities of matter into motive streams of their atomic and molecular components. They constitute the implementation or measurement of fundamental forces that became appreciable to us only after we had discovered means of making visible the invisible and making audible the inaudible. They are, of course, more than just analytical machines—they have, indeed, found wide application in many of the processes of industry and society, and their potential use appears, even at this early stage of development to be limitless.

One of the most interesting examples of this ultramodern species of scientific aid is the mass spectrometer, an instrument the character and function of which were once fully described in *The Petroleum Engineer* and enlarged upon at frequent intervals thereafter. It is not our purpose now to go into new ecstasies over the usefulness and precision of this amazing machine. We would, however, point out that, effective as it is for the purposes to which it is now applied, the mass spectrometer is by no means an end-product. Actually, in scientific progress, it may well be regarded as the "open sesame" to a great new era of molecular and atomic exploration.

Indicative of the sort of progeny we may expect from the mass spectrometer is an ingenious new portable leak detector so sensitive that it locates leaks which can not be found by any other known method.* Essentially, this instrument is a simplified mass spectrometer, designed for the single purpose of detecting minute traces of helium. It employs a mass-spectrometer tube to accomplish the electronic separation of helium molecules from all dissimilar ones, in the atmosphere being examined, and is applicable to the testing of either pressure or vacuum systems, or vessels. Helium is chosen as the tracer gas because it is inert, is present in the atmosphere in very low concentration—1½ parts per million—and being unusually light, diffuses rapidly through any gaseous medium.

The balance of the apparatus consists mainly of a vacuum pump to pull the atmosphere under test into the detector; a "sniffer" to sample leakage from pressure vessels, or a nozzle to provide a jet of helium for the testing of vacuum containers; and, finally, audio and visual means of indicating the presence of helium in the system's atmosphere. If a vacuum chamber, free from helium, be exposed to the gas, and helium be then found inside, there can be just one possible conclusion—the helium has entered through one or more leaks. With the presence of a leak established, the actual point or points of entry may then be located by going over the suspected part or area with a jet of helium. This is known as the probe method.

When helium enters the vicinity of

*Pacific Coast Editor.

*The Consolidated Leak Detector, Model No. 24-101A.

EXCLUSIVE

a leak, it is quickly drawn into the vacuum system, the time then taken to reach the detector being dependent upon the ratio of the volume under test to the speed of the evacuating pumps, and to some extent also upon the pressure at which the system is operated. The mass-spectrometer tube quickly segregates the helium and thence activates the signaling instruments. The pitch of the audible note in the sound projector, incidentally, is roughly proportional to the quantity of helium in the stream, and thus gives an approximation of the size of the leak. This may be further verified by using the meter on the control panel to establish the partial pressure of the helium that has found its way into the vacuum, and then comparing this with a standard having a known rate of leakage to ascertain the quantitative effect.

The testing of pressure vessels is in general contrived by introducing helium into the interior and then running over the exterior, or at least suspected parts of it, with a "sniffer" which continuously samples the atmosphere at the surface of the vessel, and immediately gives warning of the presence of helium. Since, as already indicated, the atmosphere normally contains about 1½ parts per million of helium, it is obvious that the sensitivity of the detector must be less than this value to avoid activation by the natural helium content of the air. The instrument is thus adjusted to a maximum sensitivity of 1 part of helium in 200,000. This sensitivity is calibrated at full throttle-valve opening and maximum pumping speed. When minute leaks in small volumes are being checked, higher sensitivity is acquired by reducing pump speed. Leaks of the magnitude of 10^{-9} c.c. per second are detectable in general application, that is, the equivalent of a leak of 1 c.c. of gas in 31 years.

We have watched one of these instruments spotting leaks in welded containers, metal tubes, and other equipment that had every appearance of being air-tight. It catches continuous porosity in steel-walled vessels where no evidence of leakage can be found even with the use of pressure and soapy water. Rubber balloons that seem to remain permanently inflated to the same extent are found to be literally riddled with small leaks when subjected to test at the maximum sensitivity of the detector. This makes the machine admirable for the testing of vacuum tubes, in which the smallest quantity of residual gas is detrimental to their life and utility. It is also highly useful, of course, in both routine and research laboratories for testing the variety of vacuum systems and instruments that are there employed today to advance production and refining techniques and improve products.

But the usefulness of the electronic leak detector is by no means confined to the laboratory. Indeed, it would be difficult to find any system, capable of being maintained under pressure or in vacuo, that could not be adequately leak-tested by this device. It has been effectively applied to the checking of a 40-foot bubble column employed in the manufacture of a highley toxic lachrymator. This had previously been tested by the most sensitive available means, that is, with ammonia water and sulphur dioxide gas. Under this test it was pronounced tight, but the detector discovered a number of leaks in the system. It was first examined under vacuum, but better results were obtained when the column was pressurized and helium injected. A sniffer was used to find the leaks and response was practically instantaneous. The leaks were finally located within extremely small areas. In fact, the sniffer can run them down with an accuracy as to location of about $\frac{1}{32}$ of an inch, and this, be it noted, is for leaks that are not even determinable by any other known method or device.

It is interesting to note that only a few ounces of helium were required in a total volume of about 900 gallons, yet it took just 15 or 20 seconds for this small quantity of gas to permeate the column from top to bottom. And, although some sensitivity is sacrificed with the pressure technique, it is still possible with it to detect leaks in systems that would be pronounced tight by any other method of testing. If, for example, a vessel contained pure helium under 15 psi, a leak of the gas to the atmosphere as small as 1/100,000 c.c. per second could be detected by the pressurizing method, which certainly makes it sufficiently perceptive for most conceivable purposes. Also, the addition of a small quantity of helium to a flowing stream frequently has no effect whatever on operations, so that no shutdown is necessary, and valves, flanges, and other connections may be checked while the plant is still on stream.

The electronic leak detector although comparatively young has already performed well in many industries. It finds valuable application in refrigeration, which is important to the oil industry, particularly in gas operations, refining, and in laboratory work. The detection and correction of even extremely minute leaks in refrigerating units is necessary to assure efficient operation. The detector has thus become an important adjunct in the manufacture of such equipment, permitting the inspection of assembly-line production with a speed and effectiveness hitherto unattainable. In the interests of economical performance and worker safety it can also be used to check leakage from ammonia or natural gas refrigeration units.

The ramifications of petroleum operation in all its phases require an infinite variety of air-tight containers and systems, and the need for an adequate leak detector in production, refining, natural gas, transportation, and research and development departments would seem to be a consequential one. With complete portability, and wide applicability in large- or small-scale checking of equipment, the unique device described here seems to answer many of the needs, and certainly appears to have an interesting future. Exercising a little imagination, it is not difficult to foresee its permanent installation in certain instances, where leaks might be dangerous to life and property. This step might be taken, for example, by so amplifying the present audio system as to announce the first indication of a leak by an easily recognizable sound.

The injection of helium into gas lines, and the detection of underground leaks, with a sniffer to bring the atmosphere overlying the lines into the mass-spectrometer tube, is already established technique. It eliminates the necessity of excavating long sections of pipe, and where parallel lines exist in close juxtaposition is unerringly accurate in selecting not only the right line but the exact spot at which the leak is taking place. One of the most attractive features of this particular instrument is that no elaborate preparations must precede an actual test. All the essentials are built into a small compact unit. The eletron-emission current used in the mass-spectrometer tube is automatically controlled so that normal variations in line voltage have no effect on the accuracy of the test. In fact, the whole thing is so well protected against error, and is so simple of manipulation that it can be operated completely satisfactorily by non-technical persons.

* * *

Second Pacific Chemical Exposition will be held at the San Francisco Civic Auditorium November 1-5, 1949, announces Marcus W. Hinson, manager. Floor plans for the show have been opened to general exhibitors. The Pacific Industrial Conference will run concurrently with the exposition, Hinson pointed out.

High LPG Recovery at New California Plant

M. E. GARRISON

PART 2

The author discusses in Part 1 the three sources of gas at as many different pressures, 50, 150, and 450 psig respectively; details of the gathering system and of gasoline plant design. Two pressures are employed in two absorbers, 450 and 150 psig respectively; gas is returned to the field at 150 psig, the most economical pressure for this purpose. Detailed material process flow calculations are given in Table 1.

Propane Refrigeration Unit

Selective absorption is further effected through the chilling of the wet gas and the lean absorption oil. Chilling the lean oil makes possible lower oil circulating rates for a given isobutane absorption factor. Chilling of the dry gas delivered at 500 to 600 psi to the gas company's sales distribution system is necessary during the summer months in order to obtain a 60 F temperature. The formation of hydrates prevents carrying the gas temperature much below 60 F while the lean oil temperature may be carried down to 45 to 50 F if so desired.

The flow sheet for the refrigeration unit is shown in Fig. 8. Liquid propane from the depropanizer column is used for filling the accumulator tank after it has been cooled properly. From the accumulator tank the liquid propane passes through a heat exchanger in which the cold propane gas from the chillers in turn cools the propane liquid before expansion. From this exchanger the propane liquid enters the oil chiller, wet gas chiller, and 600 psig dry gas chiller in parallel, being controlled by liquid level regulating valves installed on each vessel named respectively. In these chiller vessels the propane liquid is evaporated and passes off as a gas through back pressure regulating valves to a common gas line. The back pressure regulating valves are set to control or maintain back pressures of from 50 to 70 psig depending upon the temperature desired. The propane gas after leaving the chillers passes through the heat exchanger to a compressor intake scrubber and to the compressor suction. The discharge gas from the compressor passes to atmospheric coolers in the induced draft cooling tower where the propane gas is condensed as a liquid at approximately 150 psig condensing totally. The propane liquid then flows back to the accumulator tank.

Any lubricating oil usually accumulated in the bottom of the chillers is bled off to the intake scrubber and then to the drain system.

It is to be noted that the volume of propane gas handled by the compressor will vary to meet the temperature conditions required. A bypass between the suction and discharge at the compressor station is installed for the operator to open when low gas rates and cold atmospheric temperatures are encountered. This is necessary in order to prevent propane liquid forming on the compressor cylinder walls. If desired this bypass valve could be replaced with a regulator operated by the suction pressure.

Gas Flow

The 50 psig wet gas from the Helm field together with the wet gas from the Lanare field is piped through a wet gas intake scrubber and composite gas intake meter to the 50 psig pressure compressor suction header. The 50 psi pressure wet gas is compressed to 150 psig and is piped to atmospheric coolers in the induced draft cooling tower and then joins with the 150 psig wet gas from the Riverdale field on the way to the 150 psig pressure wet gas scrubber. The wet gas is then piped to the compressor suction header and to the 150 psig absorber through a regulating valve controlled by the field gas line pressure. Vent gas from the depropanizer reflux accumulator and from the depropanizer feed tank is also connected into the wet gas line to the 150 psig absorber. The vent gas from the depropanizer reflux accumulator is alternately tied to the field fuel in case a maximum yield of propane is not desired.

The 150 psig wet gas is compressed to 450 psig and is connected to atmospheric coolers in the cooling tower and then to the wet gas chiller where it is further cooled to 60 F temperature. Leaving the chiller the 450 psig wet gas joins additional wet gas from the Helm field after the meter manifold. Connections have been left so that the field 450 psig wet gas may also be chilled at a later date if desired. The composite 450 psig pressure wet gas is piped to a scrubber for the removal of condensate, and is then piped to the 450 psig absorber.

The dry gas from the 450 psi pressure absorber is piped through a dry gas scrubber, meter, back pressure regulating valve where it then splits, one part of the gas is taken through another back pressure regulating valve and delivered to the gas company's glycol dehydration unit, and the other part is piped to the 450 psig dry gas compressor suction header. The 450 psig dry gas is compressed to 500-600 psig as desired and is piped to atmospheric coolers in the induced draft cooling tower, to dry gas chiller, and to a scrubber. From the dry gas scrubber the gas passes to a sales meter and to the other gas company's pipe line distribution system.

The fuel for the boilers and fired-type preheater is taken from the 35 psig absorber primarily with a make-up connection from the compressor fuel piping. The dry gas at 140-150 psig passes from the absorber through a meter and back pressure regulating valve to field fuel. The compressor fuel connection is taken off ahead of

The Author

M. E. Garrison has been a member of the Engineering Department of the General Petroleum Corporation since September, 1928. His first post was as a draftsman. Nine months later he was advanced to Supervisor.

A native of Golden, Colorado, Garrison received his engineering training at Colorado School of Mines.

In May, 1936, Garrison became an assistant engineer and was made project engineer in August, 1947.

He is stationed at the Vernon, California, plant of the company and makes his home in Long Beach, Calif.

TABLE 2. Barrel Gasoline Plant—material process flow calculations.

Columns	38	39	40	46	47	48	49	50	51	52 (30 plus 49)	53	54	55	56	57	58	59
	35 lb. Absorber Analysis—Lean Oil 38° API Grav.—185 Molecular Weight—14.3 Vapor Equivalent—Isobutane Equilib. at 70°F											FLASH OF RICH OIL IN FLASH TANK—at 300°F 45 psig L + V — 92.8 + 7.2					
	Rich Oil Flash 160°F LIQUID WET GAS			DRY GAS—Fuel		ABSORBED		COMPOSITE Rich Oil				VAPOR			LIQUID		
Component Material	MCF	Mol %	MCF	Mol %	MCF	Gals.	MCF	Gals.	Mol %	MCF	Gals.	Mol %	MCF	Gals.	Mol %	MCF	Gals.
Methane	36.5	30.3	402.5	47.3	394.5		8.0	135.5	0.40	44.5	754	4.9	39.0	661	0.1	5.5	93
Ethane	76.5	17.3	229.5	24.1	201.0		28.5	678.0	0.95	105.0	2,500	8.6	69.3	1,650	0.3	35.7	850
Propane	396.7	27.8	369.0	27.5	229.0	6,180	140.0	3,545.0	4.82	536.7	14,700	32.2	259.0	7,110	2.7	277.7	7,590
Isobutane	260.4	8.9	117.5	0.7	6.0	196	111.5	3,645.0	3.34	371.9	12,120	17.1	137.5	4,490	2.3	234.4	7,630
Butane	471.2	12.7	168.0	0.4	3.5	110	164.5	5,175.0	5.70	635.7	20,000	25.3	203.0	6,390	4.1	432.7	13,610
C6 Residue	206.7	1.0	13.5				13.5	498.0	1.98	220.2	7,980	3.2	25.5	925	1.9	194.5	7,055
TOTALS	1,448.0	98.0	1,300.0	100.0	834.0	6,486	466.0	13,966.5	17.20	1,914.0	58,054	91.3	733.5	21,226	11.4	1,180.5	36,828
Abs. Oil	7,522.0	2.0	29.0				1,724.0	2,025.0	82.80	9,246.0	645,800	8.7	70.5		88.6	9,175.5	
TOTAL	8,970.0	100.0	1,329.0				2,190.0	15,991.5	100.0	11,160.00	703,554	100.0	804.0		100.0	10,356.0	

Lean oil—82.5 gpm 7 Theoretical Plates—Isobutane Factor—1.3. Total Lean Oil—448.5 gpm. Rich Oil—82.5 plus 9.7—92.2 gpm. Temp. Rise 13°F. Lean Oil Gas Ratio—142 gals. / MCF Dry Gas.

With a 1.3 Propane Factor and 60° Lean Oil Temp—7 theoretical plates— 95 per cent of propane is absorbed.

Columns	5	6	32	33	34	35	36	52	53	60	61 (35 plus 52)	62 (36 plus 53)	63	64	65	66	67	68	69	70	71 **	72
	450 lb. Condensate Flash at 150 lb. and 90°F L+V — 85.5 + 14.5							Gasoline COMPOSITE in Rich Oil		Composite Gasoline Still O.H.			Still R.D. Accumulator Flash 40 psig—90°F L+V— 64.8+35.2				Depropanizer Feed Tank Flash—150 lb. 100°F L+V—99+1				Calculated Depropanizer	
	450 lb. Condensate		Vapor		Liquid								VAPOR		LIQUID		VAPOR		LIQUID		Vent Gas	
Component Material	Mol %	MCF	Mol %	MCF	Mol %	MCF	Gals.	MCF	Gals.	Mol %	MCF	Gals.	Mol %	MCF	Mol %	MCF	Mol %	MCF	Mol %	MCF	Mol %	MCF
Methane	10.03	84.0	54.1	61.8	3.3	22.2	376	44.5	754.6	2.6	66.7	1,030	7.1	64.5	0.1	2.2	37.8	9.8	2.2	56.9	14.6	56.9
Ethane	8.01	63.0	18.6	21.3	6.2	41.7	994	105.0	2,500.0	5.7	146.7	3,494	13.1	119.0	1.7	27.7	17.0	4.4	5.5	142.3	33.4	130.3
Propane	15.46	121.8	15.5	17.7	15.5	104.1	2,860	536.7	14,700.0	24.8	640.8	17,560	39.8	362.0	16.6	278.8	25.1	6.5	24.8	634.3	51.7	202.4
Isobutane	6.94	54.6	3.4	3.9	7.5	50.7	1,652	371.9	12,120.0	16.3	422.6	13,772	15.6	142.5	16.7	280.1	8.1	2.1	16.4	420.5	0.3	1.0
Butane	16.51	130.2	6.6	7.5	18.2	122.7	3,862	635.7	20,000.0	29.3	758.4	23,862	22.2	201.5	33.2	556.9	10.8	2.8	29.5	755.6		
C6Residue	42.40	333.9	1.8	2.1	49.3	331.8	11,960	220.2	7,980.0	21.3	552.0	19,940	2.2	20.5	31.7	531.5	1.2	0.3	21.6	551.7		
TOTALS	100.0	787.5	100.0	114.3	100.0	673.2	21,704	1,914.0	58,054.0	100.0	2,587.2	79,758	100.0	910.0†	100.0	1,677.2	100.0	25.9*	100.0	2,551.3	100.0	390.6

Note All computations are slide rule accuracy only.
* In Column 44 used only 9 MCF Vapor pressure of total material is 157 psig at 90°F.

** COMPARE assumed and calculated Depropanizer Vent Gas. Propane balance is off about 20 MCF—Close enough for slide rule accuracy. Refer to Columns 71-72 and 32-33. Raising depropanizer column pressure will reduce the propane content of the accumulator vent gas when making maximum yield of propane.
† 910.0 MCF to be compressed by the recompressor to 150-157 psig and re-contacted with the still accumulator excess liquid in the cooling tower on the way to the depropanizer feed tank.

the meter. The compressor fuel passes through a reducing regulator to a scrubber. It is reduced to around 30 psig. Into the fuel gas line to the scrubber there is connected an emergency 50 psig wet gas connection for make-up purposes in case the fuel pressure should drop too low and for emergency shut-down purposes. The compressor fuel pressure is further reduced in pressure for the four cycle gas engine driven auxiliary pumping equipment, and is further reduced at each gas engine driven compressor to around 15 psig pressure by the compressor fuel regulating valve.

All of the main gas services pass through a meter manifold. Each gas service is protected with a stack to air line in which is installed a back pressure regulating valve. On each service stack to air line is installed a meter for measuring any gas that might pass to air due to irregular plant operation. Each service stack to air line is connected into one common large stack line which is located in the southwest corner of the plant at a safe distance away from all equipment.

For the purpose of piping convenience the arrangement at the meter manifold has been worked out into parallel meter runs which are listed from west to east as follows:

50 psig Field gas, wet gas intake meter.
50 psig Field gas, wet gas stack to air meter.
450 psig Field gas, wet gas intake meter.
450 psig Field gas, wet gas stack to air meter.
150 psig Plant dry gas stack to air meter.
150 psig Plant dry gas to field fuel meter.
150 psig Field gas, wet gas intake meter.
450 psig Plant dry gas stack to air meter.
150 psig Field gas, wet gas stack to air meter.
35 psig Plant dry gas to air meter.
30 psig Plant compressor fuel meter, (located to the north of the manifold) and at the absorbers is located the following:
35 psig Reabsorber dry gas fuel meter.
450 psig Absorber dry gas composite meter

Drip Condensate

In general the drip condensate from the 450 psig gas gathering system is expanded into the 50 psig gathering system in the field. At the gasoline plant, the 450 psig, the 150 psig, and the 50 psig, pressure condensate from the vertical drip pots located at the entrance of the wet gas to the plant

ETHYL'S single-cylinder engine test method offers refiners an economical tool for studying complex problems of varnish and sludge deposits.

Exploring Engine Cleanliness

Recognizing engine cleanliness as part of the over-all problem of engines, fuels and lubricants, the Ethyl Laboratories have worked extensively in helping to build up a background of information on the factors contributing to the formation of varnish and sludge.

This work has accented the need for an economical test method which could be used for screening and preliminary tests.

An important contribution of Ethyl's research has been the development of a test method that permits the use of a smaller engine. This new test method requires fewer over-all man hours of work, does not involve expensive dynamometer equipment, and uses only fourteen gallons of gasoline—a real advantage in research on experimental fuels. The results obtained by these two methods are comparable.

Ethyl's comprehensive and continuous research program provides information that assists refiners directly in the economical production of satisfactory gasoline and furnishes basic data which serve as a foundation for development programs related to gasolines, engines, and crankcase oils.

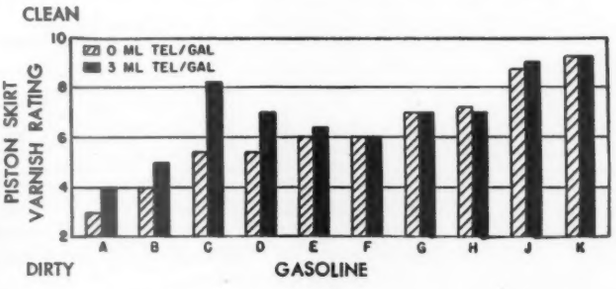


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FIG. 6. Curves showing relation between gas flashed at 35 p.s.i. gage pressure in base of reabsorber, and temperature of flash.

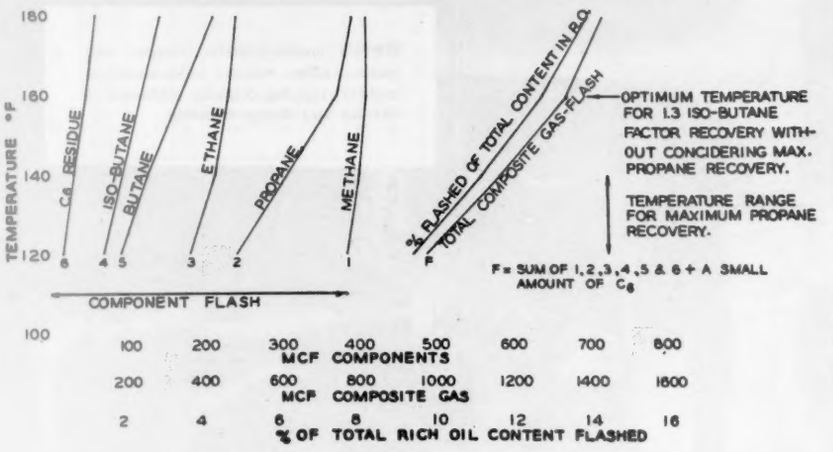
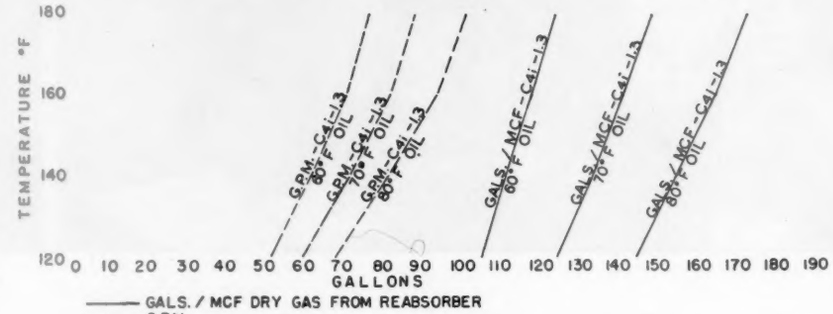


FIG. 7. Absorption factor C_{4i} based on 1.3, and C_1 C_2 C_3 equilibrium at 90°, with the absorbed medium at temperatures indicated, and based on 7 theoretical plates for 160°F-180°F.



NOTE: G.P.M. CURVES BASED UPON GAS THROUGHPUT FIGURES SHOWN IN FIGURE NO. 6

CURVES SHOWING RELATIONSHIP BETWEEN TOTAL REABSORBER OIL CIRCULATED AND OIL GAS RATIO AND VARIOUS TEMPERATURES BASED UPON A 1.3 ISOBUTANE ABSORPTION FACTOR.

are all connected into the 50 psig wet gas intake scrubber. The drip condensate from the 50 psig wet intake gas scrubber and from the 35 psig dry gas scrubber are piped to a 6 ft diam by 20 ft long dirty drip storage tank. The oil drains from the 450 psig dry gas scrubber and drip pot are also connected to the 35 psig dry gas scrubber.

The condensate from the 450 psig wet gas scrubber, after compression and cooling, is piped to the 150 psig wet gas scrubber where it is flashed. The condensate from the 150 psig scrubber is further flashed into the 35 psig recycle scrubber. From the 35 psig recycle scrubber the clean condensate is taken into a 6 ft diam by 20 ft clean condensate storage tank. In case the 150 psig condensate turns up dirty in color, it can be alternately flashed into the 50 psig wet gas scrubber where it then goes to the dirty drip tank. The clean and dirty drip tanks are good for 30 psig. Vent vapor from these two storage tanks is connected to the stack to air line and to the boiler plant fuel line. Pressure is maintained by means of a back pressure regulating valve.

The clean drips are pumped from the clean drip condensate storage tank by means of a 6 in. by 4 in. by 6 in. horizontal duplex steam pump into the reflux line to the fractionating still.

The dirty drips are pumped from the dirty drip storage tank by means of a 6 in. by 4 in. by 6 in. horizontal duplex steam pump to the oil conditioning unit heater.

TABLE 3. Gas and compressor detail data.

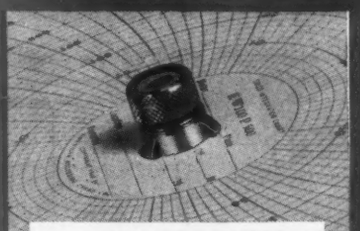
Location		General Service										Alternate Service							
Unit No.	Engine hp.	Compressor Gas Service	Cylinder Size	Gas Symbol	M²CF	Suct. Pressure	Disch. Pressure	Suct. Temp. °F	Clearance %	V.E. %	Comp. bhp	Gas Symbol	M²CF	Suct. Pressure	Disch. Pressure	Suct. Temp. °F	Clearance %	V.E. %	Compr bhp
						psig	psig							psig	psig				
K-1	400	Recycle Gas Propane	12 in. x 14 in. 12 in. x 14 in.	D	1.35	35	160	90°	22.6	55.5	100	E	1.47	55	165	80°	9.32	80.0	50
		Propane Gas Propane Gas	(2) 12 in. x 14 in. (2) 12 in. x 14 in.	E	6.50	70	165	80°	26.0	72.5	300	A E	5.32 5.62	45 55	155 165	90° 80°	9.32 11.9	84.0 76.2	342 317
K-2	400	50 psig Wet Gas Recycle Gas	12 in. x 14 in. 12 in. x 14 in.	A	2.52	45	155	90°	12.6	79.5	162	D	1.35	35	160	90°	17.2	51.5	100
		150 psig Wet Gas	(2) 7 in. x 14 in.	B	3.56	150	460	90°	24.3	62.3	230	B	4.74	150	460	90°	7.16		306
K-3	500	50 psig Wet Gas 150 psig Wet Gas	12 in. x 14 in. (2) 7¾ in. x 14 in.	A B	2.66 5.10	45 150	155 460	90° 90°	9.3 17.5	84.0 72.3	171 328	None None							
K-4	500	50 psig Wet Gas 150 psig Wet Gas	9¼ in. x 14 in. 9¼ in. x 14 in.	A	1.50	45	155	90°	11.3	81.0	97	B	1.74	150	460	90°	20.4	68.0	112
				(single acting) (Double acting multiply by 2 →															
		150 psig Wet Gas 430 psig Dry Gas	7¾ in. x 14 in. 7¾ in. x 14 in.	B	3.00	150	460	90°	8.4	85.0	194	C	9.0	430	600	90°	8.4	94.5	199
				(variable volume 4.5 M²CF to 9.00 M²CF unloader →															
		150 psig Wet Gas 430 psig Dry Gas	7¾ in. x 14 in. 7¾ in. x 14 in.	B	3.00	150	460	90°	8.4	85.0	194	C	9.0	430	600	90°	8.4	94.5	199
				(Hand operated fixed clearance)															
K-5	500	50 psig Wet Gas 150 psig Wet Gas	9¼ in. x 14 in. 9¼ in. x 14 in.	A	1.50	45	155	90°	11.3	81.0	97	B	1.74	150	460	90°	20.4	68.0	112
				(single acting) (Double acting multiply by 2 →															
		430 psig Dry Gas 150 psig Wet Gas	(2) 7¾ in. x 14 in. (2) 7¾ in. x 14 in.	C	18.00	430	600	90°	8.4	94.5	398	← Variable Volumne 14.5 M²CF to 18.0 M²CF							
				(Variable volumn 4.5 to 6.00 M²CF →								B	6.00	150	460	90°	8.4	85.0	388

Note: Balanced total compressor horsepower for each unit equals the rated engine hp for each service and for maximum gas loading for each compressor cylinder. At a later date Unit No. K-1 was connected to the 50 psig wet gas service for use during the winter months until another compressor unit could be installed. Due to the excellent performance of the induced draft cooling tower it was found possible to shut the propane refrigeration unit down during the winter months. This also provides another emergency spare set up in case another compressor goes down.

Note: M²—1,000,000

ACCESSIBLE ARRANGEMENT OF INTERIOR PARTS

Permits on-the-job operations to be accomplished with ease.



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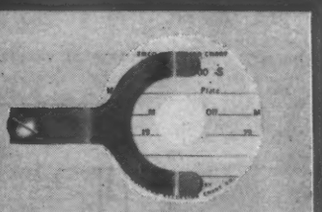

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Tells at a glance the static and differential range of the meter and the chart to be used for it.

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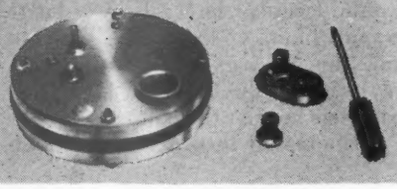

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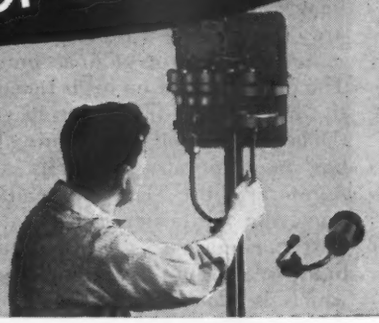
Strongly constructed especially for instrument service. Hermetically sealed. Standard type runs 8 days with one winding, chart arbor turning once in 24 hours. Converter gears permit chart rotation speed (such as 7 day and 48 hours and others) to be changed without removing clock.



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To handle varying field requirements, the Emco gauge can be converted to any of four standard ranges—20 in., 50 in., 100 in., or 200 in. by simply exchanging one high pressure chamber for another. This operation can be done on location if desired.

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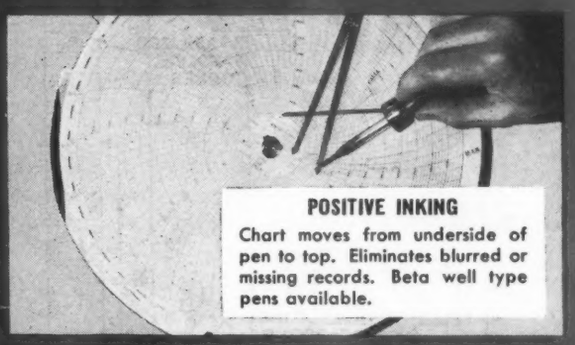

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Chart moves from underside of pen to top. Eliminates blurred or missing records. Beta well type pens available.

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The entire meter can be disassembled or built up using common, everyday tools.

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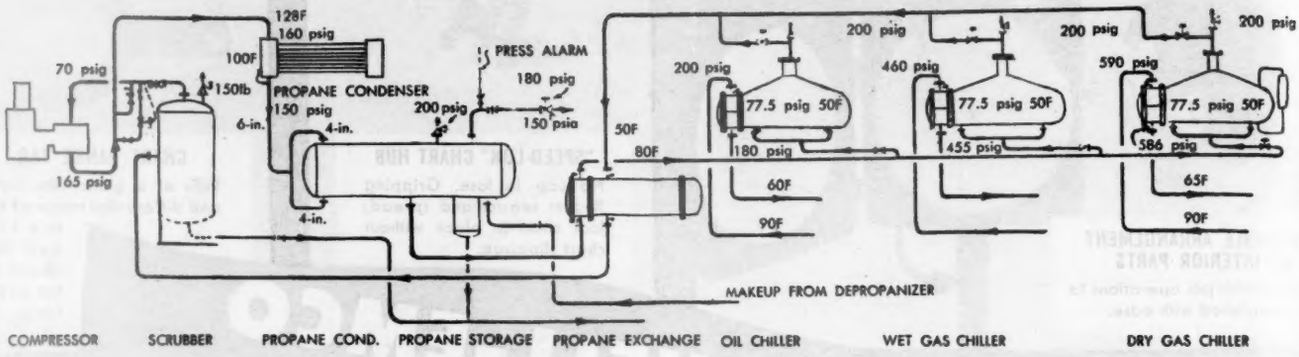

FIG. 8. Propane refrigeration.

Oil Conditioning Unit

The oil conditioning unit has to serve two purposes, namely to clean up dirty absorption oil and to recover absorption oil and gasoline from the dirty drip condensate. The unit consists of a vertical tubed fire type heater. The vapors out of the heater are connected to a tubular condenser mounted on the top of an accumulator. The dirty absorption oil is taken from the base of the fractionating still to the heater. The oil conditioning heater has an evaporating capacity around 5 gpm at 450 F. The overhead vapor line from the heater is laid to grade to the condenser which in turn is liquid sealed by the accumulator tank which is placed immediately underneath the condenser. This causes a vacuum to be created on the heater by the condenser. A vacuum of 10 in. of mercury is the optimum pressure for this type of unit.

When the dirty drip condensate is reclaimed it is pumped from the dirty drip tank to the heater. The liquid is pumped from the accumulator to the storage tanks, or to the fractionating still, or to the rich oil into the reabsorber. The oil conditioning unit is operated alternately for reclaiming dirty drips and for reclaiming dirty absorption oil. The accumulated heavy gravity black oil that accumulates in the base of the heater has to be drawn at quite frequent intervals in order to prevent coking up the heater. When to draw this oil can be determined by gravity or by the fact that as the material gets heavier the temperature has to be increased in order to maintain a proper leave and a maximum temperature can be set for withdrawal of this oil when it has been reached.

It is expected that when the volume of dirty drips exceeds the capacity of the unit that it will be necessary to install a reclaiming still. This type of reclaiming or oil conditioning unit was installed at the recommendation of the operating department. It does not have the facilities however for making controlled molecular weight oil. It merely cleans the absorption oil and removes the very heavy fractions.

Compressor Station

The compressor station consists of two Clark type RA-4 two-cycle 400 hp gas engine compressor units which were moved from another Corporation gasoline plant; three Clark type RA-5 two-cycle 500-hp gas engine compressor units; two gas engine driven and one steam turbine driven

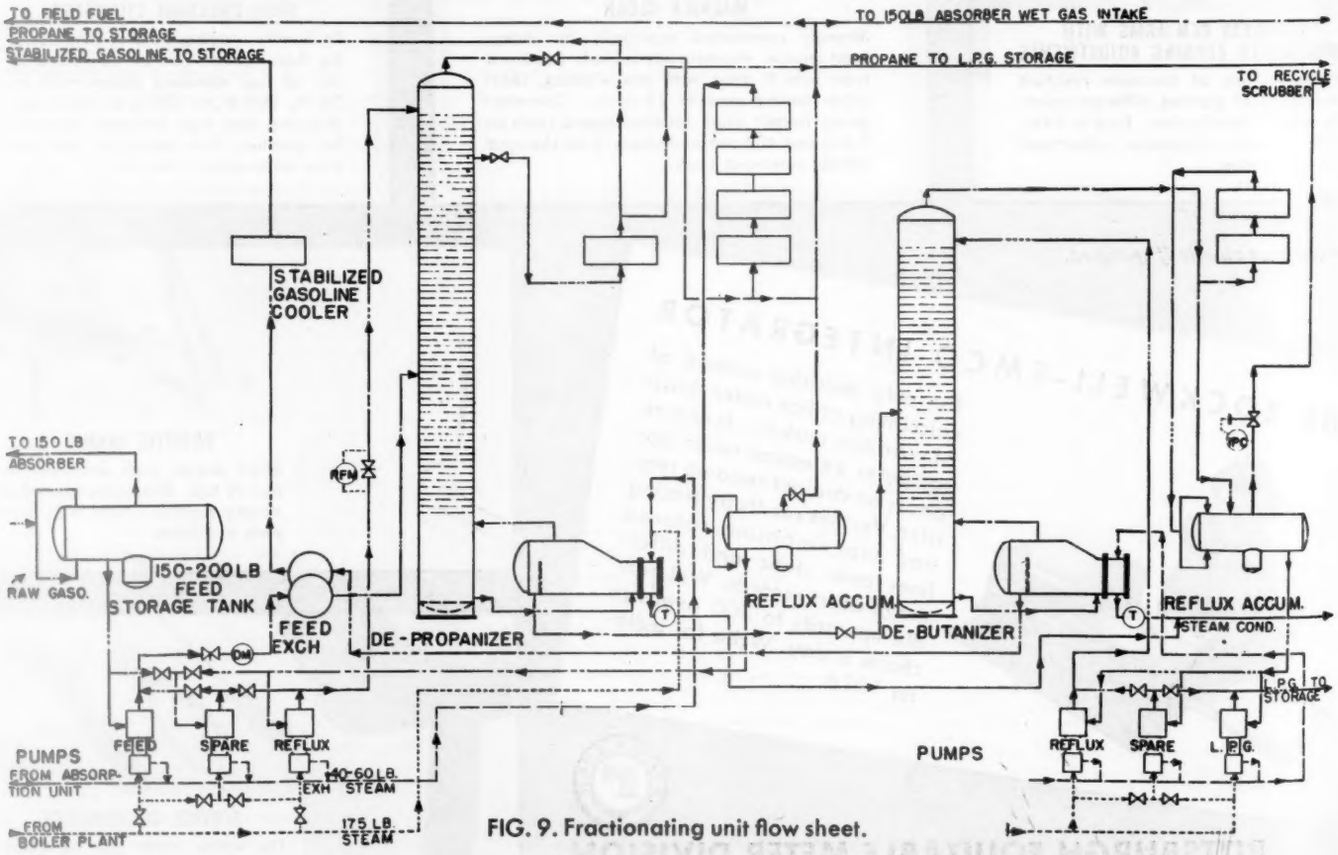

FIG. 9. Fractionating unit flow sheet.

N.B. While it is axiomatic that return on investment—the *ultimate earning power* of a refinery unit when actually on stream—is the only true evaluation of competitive engineering recommendations, initial plant costs remain a major factor in refiners' decisions on plant installations. M. W. Kellogg takes specific steps to *minimize initial plant costs* consistent with the achievement of *highest ultimate earning power.*

HOW KELLOGG CUT LINING COSTS BY OVER 50%

For many years, accepted practice has been to line regenerators with refractory tile and block insulation costing from $10 to $12 a square foot installed.

Kellogg design engineers considered this an unreasonably high expense and decided to pioneer a new type of vessel lining. Kellogg's refractory and insulating specialists consequently experimented with new materials and methods that would reduce this cost yet provide the same or better performance.

A solution was found in Kelcrete*, a new refractory material that can be "gunnited," or sprayed, on a wire mesh supported on the inner surface of a vessel. Not only is Kelcrete less expensive than tiling but it is also less costly to apply. *Total cost is about $4 a square foot installed*—more than 50% saving over old methods.

Furthermore, it exhibits excellent stability, although continuously exposed to temperatures of 1100° F... is longer lasting than other materials... and is easier to repair. Gunnited Kelcrete is now a standard material for this and similar applications in units engineered and constructed by Kellogg.

This story of Kelcrete underlines just *one* of the ever present opportunities for paring the initial cost of new refinery units—opportunities available only to the resourceful engineer-contractor who has a complete organization... one that *supplies within itself* all the requisites for obtaining unbiased solutions to initial-cost-vs.-earning-power problems.

Such completeness of organization and the close cooperation between the various specialists at M. W. Kellogg are the soundest approach to LOW INITIAL PLANT COSTS.

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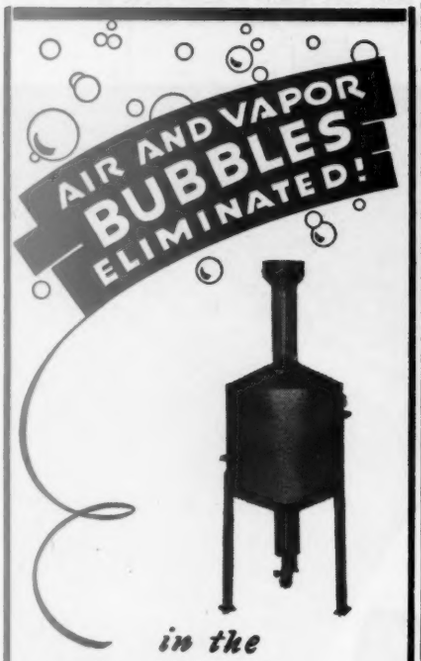

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TABLE 4. Gas and compressor summary data.

Gas Designation	N Factor at Suc. Temp.	Molecular Weight	HP Per M³CF	Unit Designation	Shut Down	Max. A Gas	Capacity Variation	Max. B Gas	Capac. Varia'n	Max. C Gas	D Gas	E Gas
							Capacity	M³CF Range				
				#1 Unit	No spare capacity for Gas E						1.35	6.50-7.09
A	1.23	21.0	64.3	#2 Unit	Spares Unit #1 on Gas D						0	
B	1.19	23.0	64.5	All	0	8.18	⟷	14.66	⟷	18.00		
C	1.26	17.5	22.1	4 Units	K-1	5.66	⟷	14.66	⟷	18.00		
D	1.13	49.0	74.0	4 Units	K-2	5.66	⟷	11.10	⟷	18.00		
E	1.13	43.8	56.4	4 Units	K-3	5.52	⟷	9.56	⟷	18.00		
E	1.13	43.8	46.1	4 Units	K-4	6.68	⟷	8.66	⟷	18.00		
				4 Units	K-5	6.68	⟷	8.66	⟷	18.00		
				4 Units	K-5	6.68	⟷	10.16	⟷	13.50		
				4 Units	K-5	6.68	⟷	11.66	⟷	9.00		
				4 Units	K-4	6.68	⟷	10.16	⟷	13.50		
				4 Units	K-4	5.18	⟷	10.40	⟷	18.00		
				4 Units	K-4	5.18	⟷	11.90	⟷	13.50		

#—No.

Note: Maximum capacity ratings are shown in the table and the direction of the arrow indicates that when one gas quantity is reduced the other gas quantity can be increased in the direction of the arrow by rearranging the clearance of the compressor cylinders. The entire range of capacity has not been indicated but only the range at the high capacity limits. By combining the hp per M³CF with the measured gas compressed, a fair estimate of horsepower balance can be made.

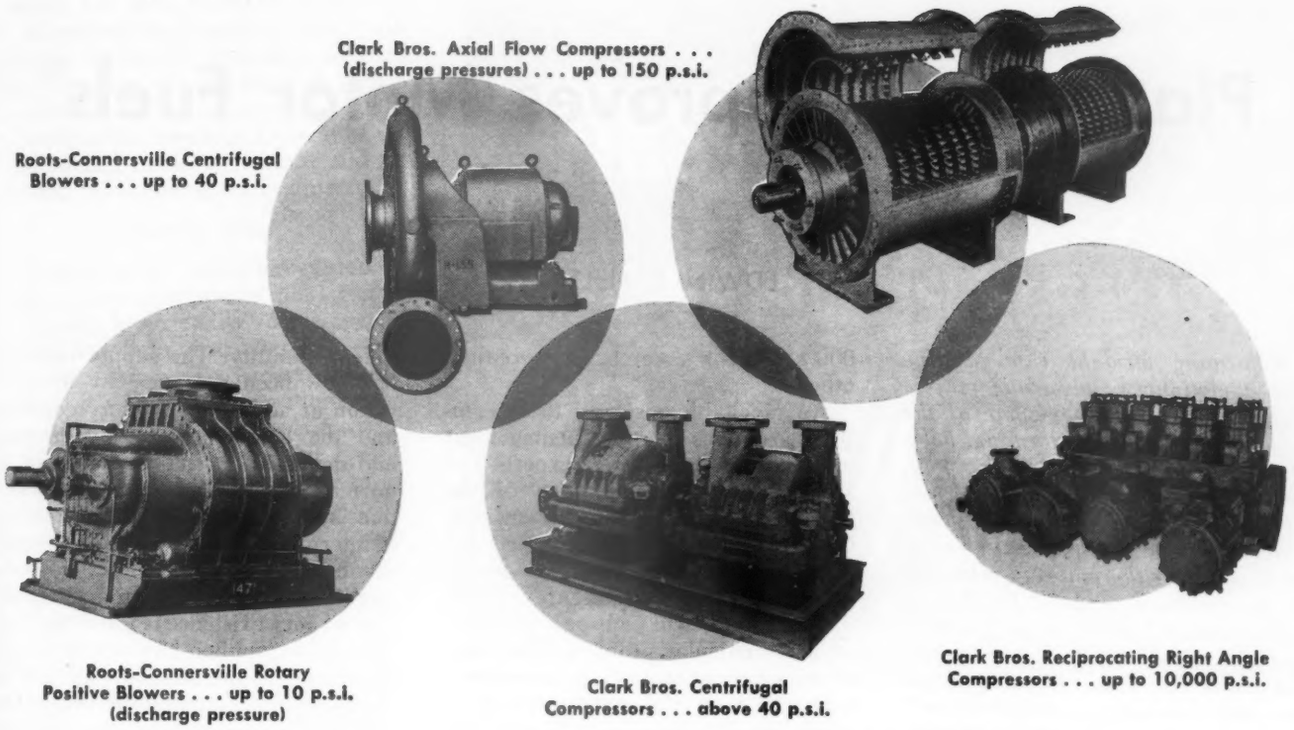
engine circulating water pumps; starting air compressor and instrument air compressor both gas engine driven; and two additional bays of building for parts storage and for overhaul and for maintenance work.

In deciding the layout for the compressor station certain quantities of gas were selected from the field data, which together with gas analysis and process calculations determined the plant layout. From this data the compression ranges and capacities selected are observed to be namely, 3,600,000 cu ft of 45 psig wet gas to be compressed to 155 psig designated as gas A; 14,000,000 cu ft per day of 150 psig wet gas to be compressed to 460 psig designated as gas B; 14,000,000 cu ft per day of 450 psig dry gas to be compressed to 600 psig designated as gas C; 1,500,000 cu ft per day of 35 psig still vapors to be compressed to 160 psig designated as gas D, and 7,325,000 cu ft per day of propane gas for refrigeration from 70 psig to 165 psig or from 55 psig to 165 psig range designated as gas E. The total horsepower for compression represented by these figures is approximately 1800 to 1870. About the time the layout was decided it was further requested to increase the 50 psig wet gas quantity to 6,000,000 cu ft per day and to provide 100 per cent spare capacity for the 450 to 600 psig compression service, or gas C.

In laying out the compressor station provisions were made so that in case of an engine shut down, the load could be shifted to load completely the remaining units in operation, and in case there was an excess quantity of wet gas it could be processed through the 150 psig absorber and allowed to go to air if necessary. Final arrangement of the compressor unit sizes was selected on this basis, remembering that we are operating two-cycle gas engines which should be operated under a full load condition in order to obtain the best operation. Equipment on hand also had to be fitted into the arrangement. Clearance pockets, valve lifters, and valve-in-head unloaders were selected so that the compressor cylinders could be operated under two alternate pressure conditions and under two alternate gas services in some cases. The foregoing Table 3 shows that there are three compressor cylinders mounted on each gas engine unit. From these data a summary was compiled which is shown in Table 4.

The compressor engine jacket water circuit is a closed system. The engine jacket water is circulated by means of two direct-connected gas-engine-driven centrifugal water pumps and a spare steam-turbine-driven standby. The pumps take suction on the surge tank and pump the water through the engine jackets. From the engine jackets part of the water passes through the compressor cylinder jackets and back to the surge tank, the other part of the water is piped to atmospheric cooling coils in the induced draft cooling tower and then to the surge tank. There is also installed a bypass line from the water line to the cooling coils back into the surge tank. This bypass together with the water from the compressor jackets is used to control the temperature of the engine jacket water at around 120 F. Since the atmospheric cooling sections are designed with low pressure drop, only approximately five pounds extra pressure is added to the engine jacket pressures. The hot engine jacket water to the compressor jackets results in longer ring life and less compressor cylinder wear, operating on wet gas. The engine lubricating oil coolers are cooled by a separate water circuit taken from the discharge of the induced draft cooling tower circulating water pumps and returned to the cooling tower basin. ***

Part 3 will be published soon.



Clark Bros. Axial Flow Compressors . . . (discharge pressures) . . . up to 150 p.s.i.

Roots-Connersville Centrifugal Blowers . . . up to 40 p.s.i.

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R-C ROTARY POSITIVE BLOWERS are built in capacities from 10 CFM to 50,000 CFM. Drives may be from direct-connected steam or gas engine, moderate-speed induction or synchronous motor, or through V-belt or reduction gear set from high-speed motor or steam turbine. Write for details.

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Reforming straight run gasoline with a platinum catalyst and recycle of hydrogen overcomes some of the disadvantages of hydroforming, polyforming, thermal reforming plus polymerization, and other methods of motor fuel upgrading. Platforming shows a yield of 95 volume per cent as compared to 66 for thermal reforming, 80 for polyforming, and 84 for hydroforming, when boosting clear research ratings to 80-85; with 3 cc TEL the platformed fuel shows 13 octane numbers improvement, as compared to 8 numbers increase for thermally reformed motor fuel.

THROUGHOUT the cycle of crude oil production rates there has been one definite major trend in the refinery, that of producing better quality products at lower cost. Accompanying and making this possible is increased technical complexity. The problems themselves are becoming increasingly complex, but with this it should be borne in mind that the best solutions are the simple solutions. Simple solutions to complex problems are the objective of those in this phase of our industry.

The increase in technical complexity appears to be greater in our industry than in most. Industries that might claim more increased technical changes are in the chemical field and those new fields based primarily on physics. Our starting material, crude oil, is composed of thousands of different chemical compounds, and we are now beginning to know more about their chemistry and physics and about how to use this knowledge in refining operations. The operation of a refinery is fundamentally based on chemistry and physics, and our technical progress is keeping abreast with advances in these fields.

Other industries would perhaps deny that this trend is in any way peculiar to petroleum. Comparison of the complexities of the major industries is not made readily. Our industry, however, appropriates $100,000,000 a year for research, far more than others.

An inevitable result of these complex problems is that management must rely upon teams of experts and specialists. The importance of the team can scarcely be overemphasized. Only when the individual experts are functioning as members of an organized unit is there any assurance that the right skills will be brought to bear on any particular problem. This matter of proper organization and smooth teamwork is so vital, and the variety of specialists has become so great, that the management of such teams has in turn become a specialized problem. The smallest refiner will have experts on his staff to deal with his daily problems, but even the largest can scarcely afford to maintain an organization diversified enough to handle all the problems that arise in selecting, installing, and operating his processes.

Motor Gasoline

During and since the war, the only problem in connection with motor fuel has been the production of a sufficient quantity. The supply problem has now been overcome by the provision of additional refinery capacity and the balancing of crude supply and demand. The industry is back to normal pre-war conditions, with emphasis on quality. As always, quality is interpreted by the public as octane number, since in all other respects quality is maintained so high normally that its very existence is unrecognized. The octane number, however, is a well-advertised property, and one that is receiving much attention today, as the engine builders resume the pre-war trend to higher compression ratio.

The latest national survey indicates average octane number for regular gasoline of 80 research and 76 motor method. This gasoline will give knock-free operation for all normal driving conditions in about 40 per cent of the cars on the road today. Similar completely knock-free operation in the other 60 per cent of the cars can only be obtained with a fuel having a research rating over 90. In any car, the octane requirement for knock-free operation varies with speed and load. The highest octane requirement is usually found at conditions of relatively infrequent occurrence; in about two-thirds of all passenger cars, this maximum requirement occurs during acceleration in high gear at speeds below 25 mph. On the average, maximum octane number is needed only 10 per cent of the time. On multiplying these percentages the average gasoline of today is found to be satisfactory over 94 per cent of the time.

This situation represents a serious waste of expensively produced octane numbers. The use of some type of two-fuel system has been suggested. There is, however, another approach to the problem. The anti-knock characteristics of fuels and fuel components are also dependent upon such engine variables as speed and load. Different hydrocarbon types respond to these variables in highly characteristic ways. The possibility therefore exists of blending fuels with anti-knock properties designed to match the requirements of the engine at all operating conditions. Real progress in this di-

The Author

Edwin F. Nelson, vice president of Universal Oil Products Company of Chicago, recently received a citation award from the University of Wisconsin, College of Engineering, for distinguished contributions to chemical engineering in the petroleum industry, in connection with the activities of Universal.

Nelson is well known among scientists and technologists in the petroleum field. He is the holder of numerous patents covering inventions in various phases of oil refining.

Born in Superior, Wisconsin, he was graduated from the College of Engineering in 1924, with a degree in chemical engineering. He has been associated with Universal Oil Products Company since 1926.

*Condensed from the paper, "Trends in Petroleum Refining," presented before the Western Petroleum Refiners Association, San Antonio, Texas, March 28-30, 1949.

rection has been prevented by lack of a laboratory test method which will give a reasonable indication of road performance. Development of such a method is now being attempted by the Coordinating Research Council of the American Petroleum Institute and the Society of Automotive Engineers.

Burner Oils

A major trend which has existed for some years and shows no signs of changing is a steadily increasing demand for light distillates above the gasoline range. To satisfy this demand, it is becoming standard practice to blend distillate fuels from all available stocks of acceptable boiling range. These blends are found to exhibit storage instability of various kinds, including precipitate formation, darkening, and soluble gum formation.

Precipitate formation may occur in periods of from a few days to a year. Blends of sweetened straight run and cracked distillates from high sulphur crudes are apparently particularly susceptible. There are, however, some cases in which precipitates have formed even in unblended straight run distillates from high sulphur crudes. It is known that disulphides contribute to precipitate formation, and that the bad effect of sweetening is due to the conversion of the foul-smelling but innocuous mercaptans into sweet but dangerous disulphides. Another known source of trouble is caustic washing, which may leave sodium salts of organic acids dissolved in the oil. These salts may be removed by a subsequent water wash, and in certain cases it may be advisable to have a filtration after the water wash. In certain circumstances it is possible by using dilute caustic—less than 5° Bé—to reduce the sodium salt pick-up by the oil and eliminate the need for water wash. In the case of some blends where precipitate formation is particularly rapid, a reasonably stable product is obtained by carrying out the filtration after several days' storage.

Solvent extraction to remove heavy aromatic oils and improve cetane number may offer a possibility of upgrading heavy cracked distillates.

Residual Fuel

In sharp contrast to the expanding demands for distillate fuels, heavy fuel oil markets are experiencing a steady decline. Perhaps the most important factor in this trend is the huge expansion in crude runs, particularly the heavier, heretofore marginal crudes, since the war, primarily to meet demands for other products. This has automatically produced a corresponding increase in heavy fuel

for peak efficiency

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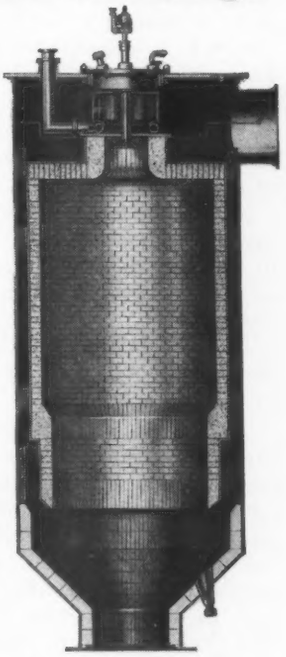

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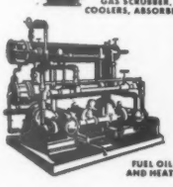

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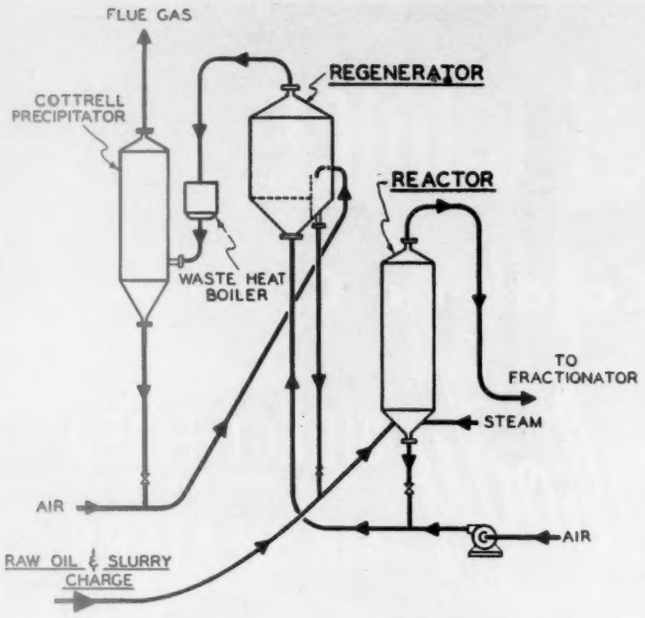

FIG. 1. Flow chart of a typical wartime fluid catalytic cracking unit, an improvement over the first fluid unit built in 1942.

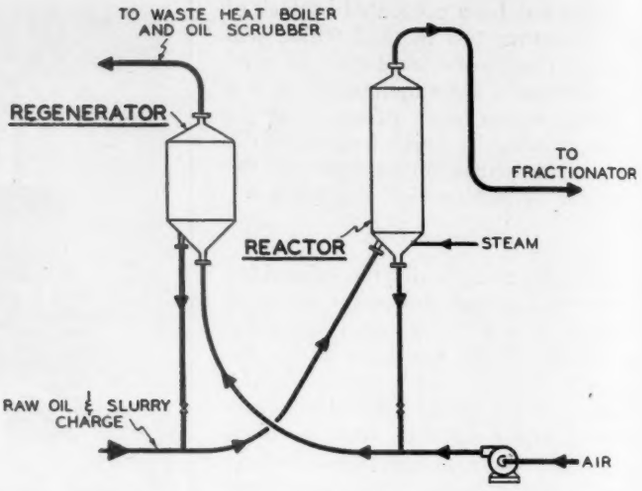

FIG. 2. Pilot plant flow chart that brought out Frontier type midget catalytic cracking unit, showing advances in design.

oil supplies without a compensating increase in demand. The refiner is thus under increasingly heavy economic pressure to reduce his residual fuel production. A variety of methods are available to accomplish this object, depending upon the operations presently conducted. Refineries that have only topping facilities have the following choices:

1. Adjustment of crude tower operation to produce maximum amounts of distillates.
2. Installation of a vacuum unit to produce virgin asphalt. The wisdom of this step depends largely upon the asphalt markets to which the refinery has access.
3. Installation of vis-breaking, thermal cracking, catalytic cracking, or coking units.

More typical refineries in which some of these processes are already installed have a correspondingly limited choice. Refineries without catalytic cracking facilities can achieve a very substantial reduction in residual fuel production by installing such facilities. In a typical refinery processing Mid-Continent crude, this step will reduce residual fuel by 30 to 40 per cent.

Petrochemicals

The production of petrochemicals continues to expand, and most refiners who have not yet entered this field are looking at it longingly. There are, however, various difficulties which frequently appear on careful investigation. One of these is that the light olefins, which are the most important petrochemical raw material, are available only in sufficient quantities at rather large refineries. Another difficulty is the substantial capital investment involved in most petrochemical developments. The smaller refinery, however, may occasionally find the opportunity to dispose of raw materials to a nearby chemical plant, or even to carry out a limited amount of chemical manufacture. In the latter category, a number of refiners have found it profitable to modify their poly plant operations to produce propylene tetramer, which is an intermediate in detergent production.

Catalytic Cracking

Catalytic cracking offers an interesting illustration of the rather complex solution to a complex problem followed by simpler solutions as the problem was further investigated. The first commercial fluid unit was built by the Standard Oil Company of Louisiana at Baton Rouge, and placed in operation in 1942. This unit was the result of bold and brilliant pioneering by the Jersey organization. Subsequent experience has shown, however, that great simplifications in design are possible.

Fig. 1 shows the bottom draw-off design as it was used in most of the fluid units built during the war. The separate hoppers in the catalyst circuit have disappeared, and the operating flexibility of the process has been enhanced by the possibility of variable reactor catalyst inventory.

This design was not accepted as the ultimate. In our Riverside laboratories we built a number of pilot plants to study various types of designs. One of these, which is shown in Fig. 2, was found to have considerable merit, and it became the prototype of the Frontier unit, which was then the smallest commercial fluid unit built. Noteworthy features of this design are the equal elevation of reactor and regenerator, which was obtained by operating the regenerator under pressure, giving minimum overall height, and the re-

TABLE 1.

Company	Location	Design Capacity, Bbl/Stream Day
Aurora Gasoline Co.	Detroit, Mich.	4,500
The Ohio Oil Co.	Robinson, Ill.	12,400
The Standard Oil Co. (Ohio)	Lima, Ohio	20,750
The Carter Oil Co.	Billings, Mont.	10,000
Continental Oil Co.	Billings, Mont.	7,000
Rock Island Refining Corp.	Indianapolis, Ind.	5,000
Coeden Petroleum Corp.	Big Spring, Texas	6,000
The Globe Oil & Refining Co.	Lemont, Ill.	6,000
Wood River Oil & Refining Co., Inc.	East St. Louis, Ill.	7,000
Panhandle Producing & Refining Co.	Wichita Falls, Texas	1,500
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The results obtained with yet another plant were sufficiently interesting to justify construction of an improved pilot plant, shown in Fig. 3. Here the reactor flow is concurrent and the oil charge is used to lift the catalyst. This pilot plant was operated succesfully for some time, and a number of commercial designs of this type were studied.

A number of other designs have been worked out in engineering detail, and several of them have been tried on the pilot plants. As a result of these studies, it was concluded that the design shown in Fig. 4 represented the most advantageous design from the standpoint of capital investment, operating cost, and yield and quality of product. The first commercial installation of this design was made by the Aurora Gasoline Company at Detroit, Michigan, and this plant has now been in operation almost two years.

Considering all the fluid catalytic cracking designs, there has been or is being installed a total capacity of about 1,000,000 bbl per day, of which about 475,000 bbl has been completed or begun since the end of the war.

Aurora is the only unit of our improved design in operation today. There are, however, nine units, with a total charging capacity of approximately 80,000 bbl per day, of this design under construction at the present time, and several will be in operation this year. Table 1 lists the refineries installing this type of unit and the capacity of each unit.

Comparison of the original Jersey installation in 1942 and our latest design shows that the fluid process has been greatly simplified. Along with this simplification and the consequent reduction in plant and operating cost, we find a steady expansion in the number of refineries possessing fluid units.

Cracking Catalysts

While improvements have been made in the mechanical features of catalytic crackers, the catalyst is still the vital part of the process. Continuous research and development is in progress to improve "product distribution," quality of products, and catalyst consumption. On product distribution the effort has been concentrated on reduced coke formation, in that the coke burning equipment, the regenerator, represents a substantial portion of the catalytic cracker, and in most cases limits plant capacity.

At present, three basically different types of cracking catalysts have been developed and are used commercially. In the order of development these are: (1) the natural catalyst, as typified by superfiltrol, an acid treated bentonite clay; (2) silica-alumina catalyst, which consists fundamentally of alumina with silica gel, and (3) silica-magnesia catalyst, which is similar to silica-alumina except that magnesia replaces the alumina.

Natural catalyst, being a natural product, is less uniform in quality than the prepared synthetic catalysts, and has the disadvantage of being adversely affected when exposed to high sulphur feed stocks and higher temperatures. It is, however, lower in price per pound than the synthetic catalysts, and may therefore be attractive where circumstances will permit its use.

Synthetic silica-alumina catalyst was of extreme importance during the war years when catalytic cracking was called upon to bear the brunt of the aviation fuel and synthetic rubber programs. It continues to hold a leading position due to its properties which combine catalytic stability and high octane of the gasoline produced.

Silica-magnesia catalyst was developed in the early days of catalytic cracking, but is just beginning to become of interest commercially. Silica-magnesia is commanding attention because of its better resistance to steam deactivation and because it offers a means for obtaining a greater yield of gasoline from a given quantity of feed stock. This additional gasoline is obtained largely through a reduction in yield of C_4 fractions. The gasoline produced is less volatile and lower in octane number than that obtained through use of silica-alumina catalyst.

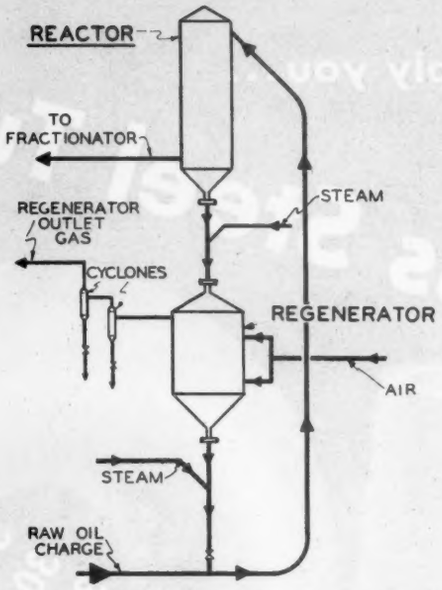

FIG. 3. Concurrent flow reactor design, a definite step in the right direction for simplifying and improving the fluid catalytic process.

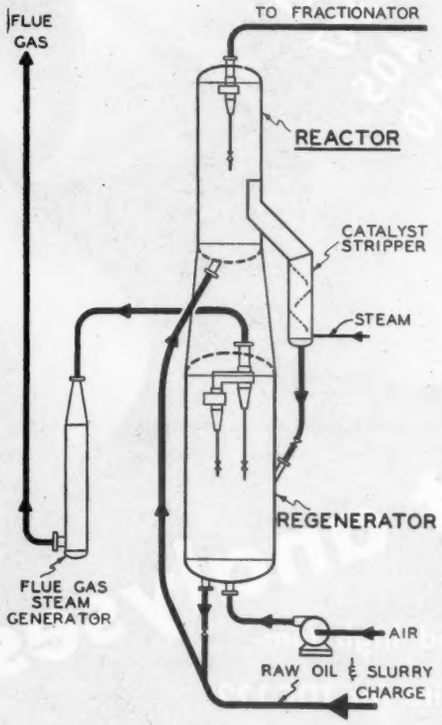

FIG. 4. Simplified single-tower catalytic unit as they are designed at present. Nine units of this type are built or building.

Treating Catalytically Cracked Gasoline

The production of catalytic gasoline introduced certain treating problems. These gasolines are fundamentally more stable than thermal gasolines, but contain small concentrations of thiophenols and other acid oils. Thiophenols are extremely detrimental to storage stability, but fortunately are quite acidic and are easily removed by a simple caustic wash. Acid oil content must generally be reduced in order to avoid gum formation; this is also accomplished by a caustic wash. The addition of a potent synthetic inhibitor to caustic washed catalytic gasoline will almost always result in a product of superior stability characteristics. The mercaptan content of catalytic gasoline is extremely low and if the proper inhibitor is added, sweetening will occur in the run-down tanks usually within a few hours.

Reforming

The trend to higher compression ratio and consequent higher octane requirement has been discussed earlier. It is well known that the major problem in raising the octane level of the total refinery gasoline output is created by the large volume of low-octane straight run gasoline. The industry has had available a number of processes for up-grading straight run

TABLE 2. Comparison of yields in reforming a 200-400 F Mid-Continent naphtha, 12.0 K, 35 motor clear octane number.

	Thermal Reforming	Thermal Reforming +Polymerization	Polyforming	Hydroforming	Platforming
Yield—Volume per cent 10-lb RVP or Less	66	80	80	84	95
Outside Butane required for 10-lb RVP—Volume per cent	0	2	0	6	4
Yield—Volume per cent including outside butane	66	82	80	90	99
Octane Ratings					
Motor Method (F-2)					
Clear	75	75	75	75	75
With 3 cc TEL	84	84	85	86	87
Research Method (F-1)					
Clear	85	85	86	81	80
With 3 cc TEL	93	93	..	93	93

TABLE 3. Typical results in platforming various charge stocks.

Type of Charging Stock	Straight-Run Naphtha and Gasoline					Natural Gasoline
Source of Charging Stock	Michigan	Pennsylvania	Mid-Continent	Mid-Continent	Gulf Coast	Cotton Valley
Properties of Charging Stock						
Gravity, °API	58.0	56.7	54.2	57.7	57.6	68.0
Boiling Range, °F	158—387	226—350	182—402	108—392	132—399	106—359
RVP, Lb.	1.9	0.5	0.4	5.4	5.0	6.6
Sulphur, %	0.11	0.06	0.03	...	0.02	0.01
Characterization Factor	12.09	11.95	11.95	11.99	11.95	12.30
Molecular Weight	119	116	125	112	112	98
Octane Rating Motor Method (F-2)						
Clear	24	41.8	34.6	48.9	50.1	56.8
With 3 cc TEL	39.7	62.9	59.1	69.8	73.3	78.9
Research Method (F-1)						
Clear	24.9	39.2	34.8	49.5	54.6	57.2
With 3 cc TEL	41.2	61.3	60.3	70.0	74.5	80.0
Properties of Product Reformate						
Yield, Volume % Charge	93.0	94.1	91.3	93.0	93.1	90.5
Gravity, °API	58	57	53	55	57	70
Boiling Range, °F	100—410	100—370	98—410	100—430	102—415	95—375
RVP, lb	9.5	9.4	8.4	10.1	9.5	10.0
Sulphur, %	0.01	0.006	0.003	.....	0.002	0.001
Octane Rating Motor Method (F-2)						
Clear	77.0	75.7	78.3	77.2	78.2	77.0
With 3 cc TEL	87.5	87.3	88.5	88.8	89.2	89.5
Research Method (F-1)						
Clear	81.5	80.6	84.7	84.3	85.0	80.9
With 3 cc TEL	92.5	92.2	94.5	95.1	95.0	93.5

gasoline. Each of these processes suffers from one or more of the following major disadvantages: (1) Limited octane number improvement, (2) high volumetric loss, (3) high plant and operating cost.

These processes, nevertheless, have been more and more widely adopted as a result of irresistible pressure for higher octane number. They include mercaptan extraction, hot clay or bauxite treatment, thermal reforming, thermal reforming plus catalytic polymerization, polyforming, and hydroforming.

The first two of these are essentially desulphurization processes, which give moderate improvements in leaded octane numbers at high yields and low operating costs. Refiners so fortunately situated that they can meet their octane requirements by such processes will continue to find them satisfactory.

The other processes listed are capable of producing substantial improvement in octane number, at the inevitable price of lower yield and higher cost. Thermal reforming, an earlier development of Universal, has been in commercial operation since about 1931. The most important reaction in thermal reforming is cracking. All hydrocarbons can be cracked, but in general the paraffins are somewhat more susceptible to this reaction than other constituents of straight run gasoline. The liquid products of paraffin cracking have improved octane numbers both because they are lower in molecular weight and because they are somewhat unsaturated. It is evident from this picture that thermal reforming does have a certain inherent selectivity.

Unfortunately, the steep initial slope of the thermal reforming yield-octane curve is not long maintained, and a limiting octane number is reached which cannot be increased significantly no matter what loss is taken. This situation reflects the fact that the inherent selectivity of thermal reforming is almost completely exhausted at a yield of 80-85 per cent. The products of selective thermal reforming are not of exceptionally high octane number, and hence the yield-octane curve becomes flat at an undesirably low level.

The loss in thermal reforming is predominantly to gas. This gas has a substantial olefin content, and polymerization is a natural supplement to thermal reforming. The most common form of this combination is the use of the UOP polymerization process to convert C_3 and C_4 olefins to polymer gasoline. The addition of this polymer to the thermal reformate raises both yield and octane number, and therefore makes a substantial improvement in the yield-octane curve. Even this improved curve, however, eventualy flattens out at too low an octane number.

Polyforming is an operation that combines thermal reforming with polymerization. By recycle of C_3 and C_4 gases to the reforming zone, their olefinic constituents are to some extent forced into liquid-forming reactions. While the chemistry is not identical in detail with that of the thermal reforming-catalytic polymerization combination, the same general considerations are applicable.

Hydroforming is a completely different approach to the problem of straight run gasoline octane improvement. It differs from the operator's viewpoint in being a catalytic process, in recycling large amounts of hydrogen, and in requiring frequent regeneration of the catalyst by burning off carbon. From the chemist's standpoint the differences are just as great. While the typical reaction in thermal reforming is cracking of heavy paraffins to lighter paraffins and olefins, in hydroforming it is dehydrogenation of naphthenes to aromatics. In hydroforming, as in thermal reforming, the principal by-product is light gas. In this case, however, the gas is saturated, and cannot be converted to polymer. The yield-octane curve for hydroforming is similar to that for thermal reforming plus polymerization.

The Platforming Process

Universal is happy to announce a new process for improving straight run or natural gasoline. A part of the success of the process is due to the use of platinum, and our research and development departments have become so used to referring to the process as "Platforming" that we have decided that at this time we would officially christen it. Therefore our new catalytic reforming process is "Platforming."

The development of Platforming has been a cooperative effort of many

departments and individuals. Dr. Vladimir Haensel, who conceived the original idea and directed the research group carrying out this work, is now preparing, and will present as soon as possible, a paper giving the scientific phases of this process. Since we are now ready to offer this process to refiners, we will present a few of its interesting features.

Platforming is a catalytic process for improvement of straight run or natural gasolines which combines the desirable features of:

1. Large octane number gain.
2. Low volumetric loss.
3. Moderate plant and operating costs.

The great yield-octane advantage of Platforming is demonstrated by Table 2, showing comparative results on a typical Mid-Continent naphtha.

The ideal reaction in hydroforming is dehydrogenation of a naphthene to an aromatic. This reaction is beneficial to the octane number, but involves a severe volumetric loss, due to the high density of aromatics. In most straight run stocks, however, 60-80 per cent of the material cannot undergo this ideal reaction but is subject to less desirable side reactions. The situation is reminiscent of thermal reforming, where only the higher boiling paraffinic part of the charge is capable of the preferred reaction. In both cases the predominant part of the charge has no possibility of a beneficial reaction.

Considerations of this character played an important role in the development of Platforming, which combines many of the best features of both hydroforming and thermal reforming. Platforming is like hydroforming in being a catalytic process in which hydrogen recycle is employed to suppress carbon formation. In Platforming, however, this suppression is substantially complete, and the operation is continuous and non-regenerative, like thermal reforming. In Platforming, naphthenes are converted to aromatics, high boiling paraffins to lower boiling ones, and low boiling paraffins isomerized, thus providing a desirable reaction pattern for almost all parts of the charge.

The foregoing discussion explains in a general way how Platforming can produce the superior results shown in Table 2. While the theory is relatively simple, its actual working out has been a long and difficult process. It has been necessary to obtain the proper balance between aromatization, hydrocracking and isomerization reactions while maintaining conditions that suppress carbon formation. This has been accomplished largely by unusual techniques of catalyst manufacture.

The Platforming process is applicable to all types of straight run stocks in the gasoline boiling range. Typical results on a variety of stocks are shown in Table 3. It will be observed that Platforming gives about 90 per cent sulphur reduction. The Platformate has an end point slightly above that of the charge, but does not require rerunning. ASTM gum is low, and inhibitor susceptibility satisfactory. Of considerable interest is a road rating of 100 on a leaded Platforming gasoline with a 95 research rating.

The plant is simple, involving merely a preheating and reactor section, a recycle gas compressor, and conventional fractionation for feed preparation and product recovery.

The installation cost for Platforming is about the same as for thermal reforming plus polymerization. The operating cost is slightly greater than for thermal reforming plus polymerization for the same octane level. The substantial yield advantage for Platforming makes this process more economical at octane levels as low as 85 research with 3 cc of lead. The margin favoring Platforming becomes increasingly great for higher octane levels. * * *

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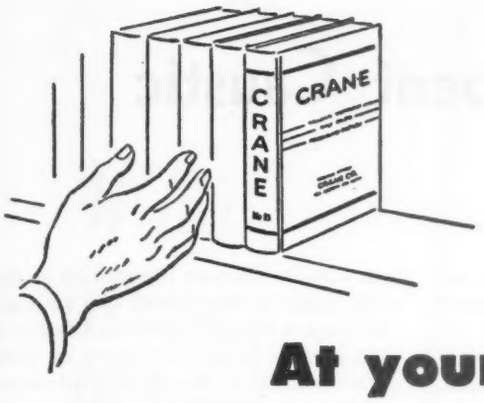

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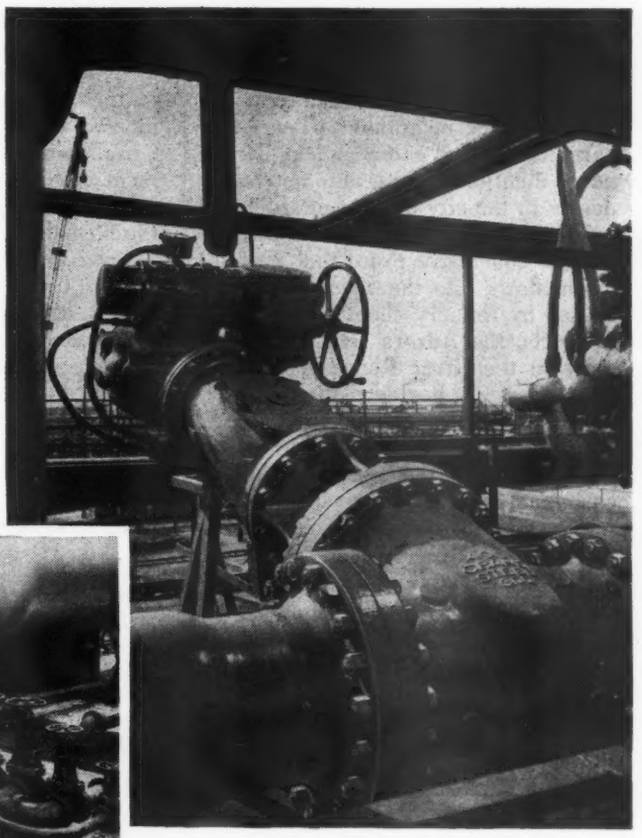

Crane 14-inch, 300-pound, motor-operated gate valve on gas line atop compressor house at catalytic cracking unit.

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One Way to Treat Spent Caustic

By J. C. ALBRIGHT

As a result of more restrictions and regulations applied to refiners of crude petroleum in the Detroit area of Eastern Michigan by the State Fish and Game Commission, the Federal Government and the International Pollution Control, Canada, and the United States and the Province of Ontario and the State of Michigan, they, the refiners, are progressively being blamed for anything which may find its way into the Detroit River which 'raises a stink,' or otherwise creates a water condition which has, or can easily become obnoxious. Not by any conceivable stretch of imagination can all of the 'dirty' water be attributed to the refiners since they are relatively few in number when compared to the steel and chemical plants, not to mention the vast automotive industry in the city of Detroit and suburban areas. So that they can always present conclusive proof that no pollution flows into the river and lakes caused by refinery chemicals and by-products, the Aurora Gasoline Company in the River Rouge section of Wayne County has developed a process to treat spent caustic for the extraction of hydrogen sulphide and phenols so that the resultant sodium carbonate can be dumped into the sewers without damage to animal or plant life.

The accompanying simplified flow-sheet is more or less self-explanatory, and the operation of the system and the method of using it can be varied easily to suit the condition of the spent caustic and the degree of hydrogen sulphide stripping required. The chemical compound treated is the conventional NaOH solution prepared by melting the solid obtained in drums or by diluting the liquid to the concentration necessary for extracting hydrogen sulphide and perhaps phenols from cracked and synthetic gasolines produced in the fluid catalytic unit operated by Aurora if such gasoline is not completely desulphurized in the process of manufacture. Obviously, the caustic solution is operated to the 'extinction' point as a matter of economics, and when 'dead,' it is withdrawn from the treating equipment circulation system and pumped to the vessel on the left as shown in the flow sheet.

From this vessel, a 2-in. line leads to a unit made up with a 30 gpm all-iron centrifugal motor-driven pump to operate against a maximum head of 30 psig which discharges through a 1½-in. line to either one of two points of disposition. In batch operation, as the unit is operated, the pump delivers the spent caustic, or sodium sulphite to the contact column of the caustic treating system. This column is a vessel 2-ft. ID and 20-ft high mounted on a 36-in. skirt or foundation so that the outlet of the vessel can be made through a flanged opening attached to the bottom head. Ten trays, or plates are installed in the upper mid-section of the tower as fractionating or stripping plates. Each plate has a 1-ft radius with 8 in. of one side sheared off where the usual down-comer of a bubble tray would be located. The trays are made from ¼-in. plate and each tray is perforated with 18 one-in. holes located on 4-in. centers. The top of the column is equipped with a mist extractor so that liquid caustic solution will not pull over entrained with the released material flowing from the nozzle in the top of the upper head.

Spent caustic from the supply tank, discharged from the centrifugal pump enters the contact column above the first tray and spills downward alternately from one plate to another to the fluid section in the base of the column. A reboiler, made of a horizontal drum 3-ft ID by 15-ft long sets on concrete cradles beside the column, and contains a cap-welded 3-in. line that lays closely to the lower side of this reboiler vessel. The 3-in. line contains a double row of perforations located 90 deg apart and placed so that each row is 45 deg up the side of the pipe from the bottom center line. The holes are drilled with a ½-in. bit equally spaced from one end to the

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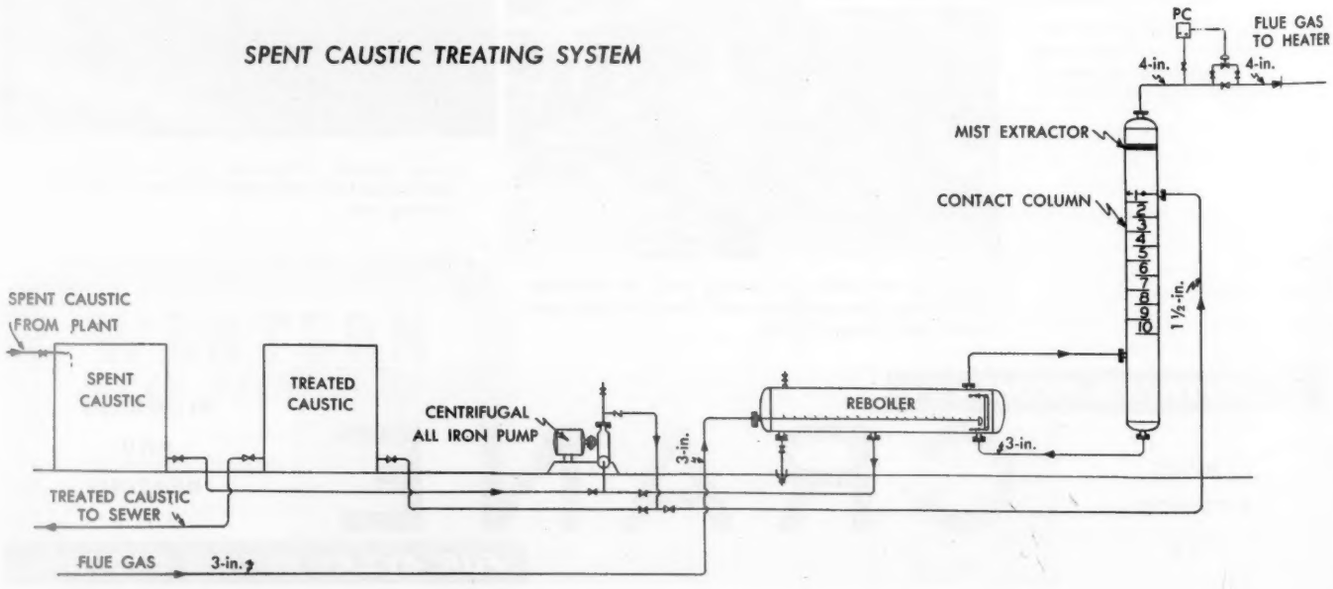

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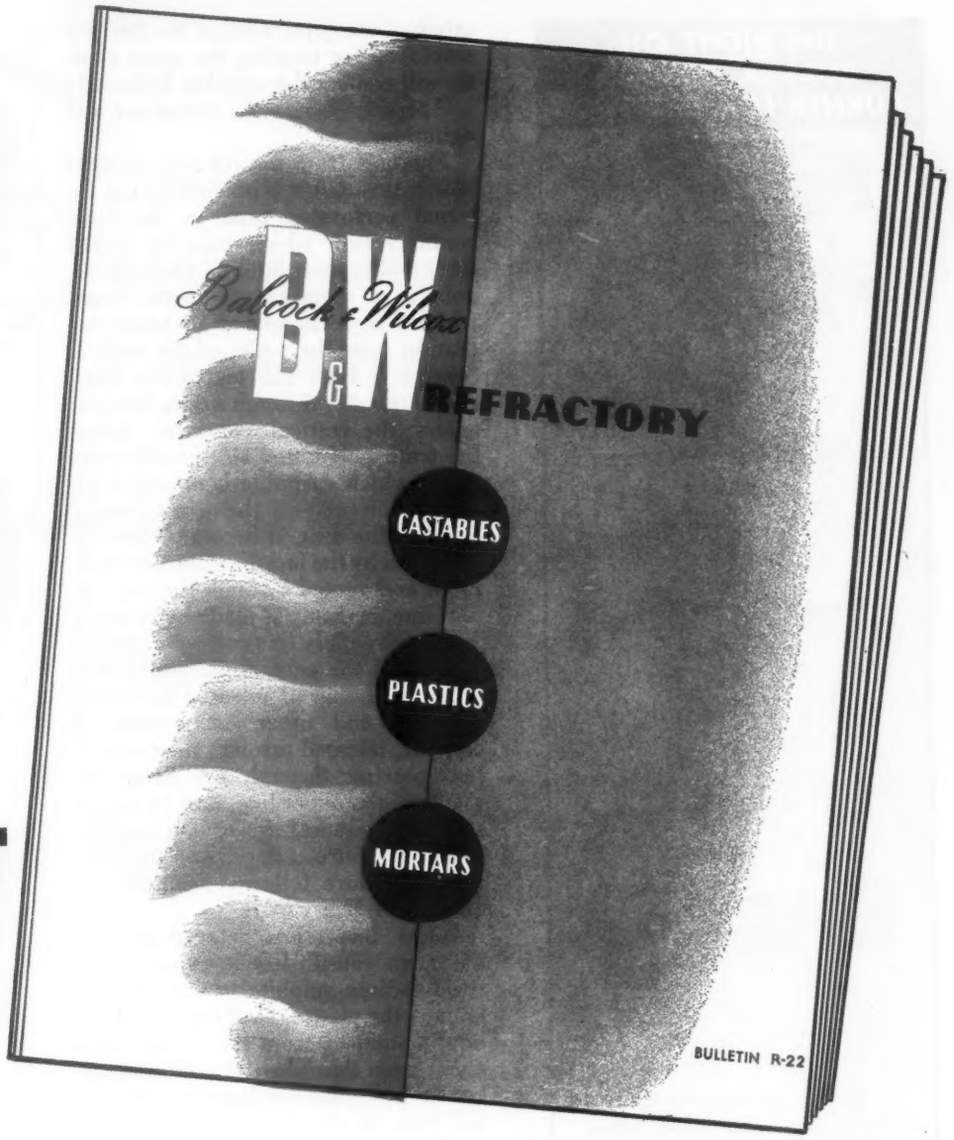

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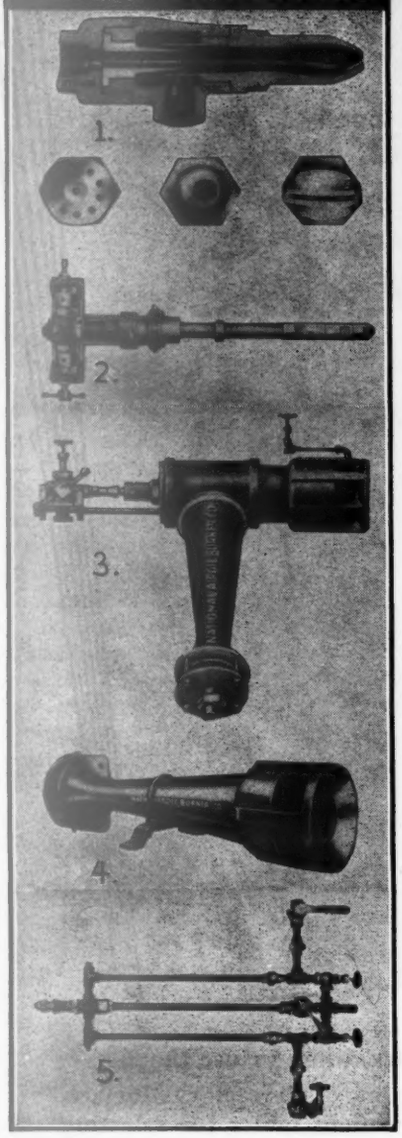
THE *RIGHT* OIL BURNER OR GAS BURNER *FOR YOUR JOB*



1. TYPE "S-A"
(For use where steam is available) *atomizes thoroughly* and *burns completely*, the lowest and cheapest grades of fuel oil and tar, requiring only low oil pressure and temperatures.

2. TYPE "S-A-L"
(Large capacity burner similar to TYPE "S-A-R") is adaptable in combination with powdered coal burners in large boilers.

3. COMBINATION GAS AND OIL BURNER
—the "AIROCOOL" Gas Burner in combination with a TYPE "S-A-R" Oil Burner.

4. "AIROCOOL" GAS BURNER
(Of venturi type) assures low turndown without burnback.

5. TYPE "S-A-D"
(Refuse Oil Burner) burns acids or caustic oils, sludges, asphalts, tank bottoms, polymer oils, heavy petrolatum, organic oil residuums, waste cutting oils, sulphite pulp liquors, etc.

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Main Office and Factory
1259 EAST SEDGLEY AVENUE, PHILADELPHIA 34, PA.
Texas Office: 2512 South Boulevard, Houston 6

other of the pipe, so that the flue gas employed for treating the spent caustic will contact the solution intimately and produce maximum turbulence and agitation.

Flue gas from the refinery units is blown through a 3-in. line to the internal perforated pipe in the horizontal vessel, which may be called the reboiler, and bubbles through the volume of spent caustic in the vessel which has accumulated in batch operation from the outlet of the vertical contactor. Flue gas leaves the horizontal reboiler through a 6-in. line and enters the vertical contactor below the tenth perforated side-by-side tray above which stripping is obtained. If, while recirculating the spent caustic through the unit, it becomes too concentrated by the fact the water is evaporated and vented through the top 'vapor' line, make-up is made by opening a 1½-in. supply line connected to the suction of the centrifugal pump. Vapors, consisting of released hydrogen sulphide and other compounds of sulphur, released through the controls and passing through the flame arrestor in the outlet line, flow to one of the combustion spaces of a unit in the plant to be burned in the same manner and procedure followed generally to dispose of H_2S vapors.

When inspection determines that the spent caustic has been converted from sodium sulphite to sodium carbonate, the plant is shut down and the liquid pumped from the system to a receiver so that phenols will accumulate in a skimmer section for removal and may be placed in drums for disposition as economics and use dictate. The sodium carbonate solution is then drained to the sewage system of the plant, or, recovered as Na_2CO_3, or perhaps $Na_2CO_3.10H_2O$, either of which is widely used in various manufacturing processes. * * *

Sulphur From Gas

The Hancock Chemical Company's new $1,000,000 plant for the recovery of sulphur from oil refinery gases recently was placed in operation. It has a capacity of 100 tons a day of hydrogen sulphide.

The plant, the only one of its kind in the United States, will process hydrogen sulphide from the Richfield Oil Corporation and The Texas Company refineries. W. T. Hancock, president of the company, said a new unit almost identical with the one now in operation will be built in the near future.

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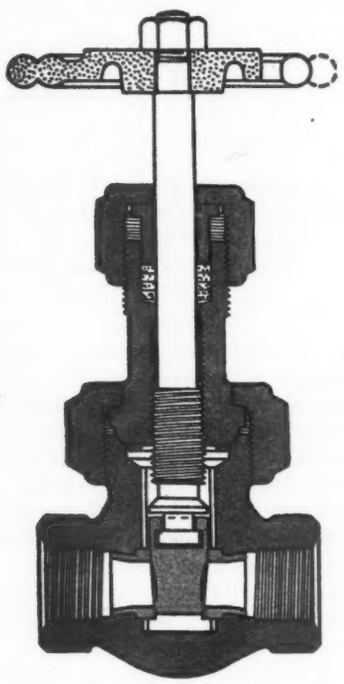

Operating men everywhere rate these valves as tops for general gate valve service including meter and gauge lines, drip and drain lines, etc. Series 9850 valves have drop forged carbon steel bodies and bonnets, rolled in 11½-13% chrome stainless steel seat rings which can be easily renewed, and a solid stainless steel wedge. A ground joint insures tightness between body and bonnet. The stuffing box can be repacked under pressure when the valve is open.

Also available is Series 9750, completely fabricated from 18-8 stainless steel for services where internal or external corrosion is severe.

Series 9850-F8 valves have 18-8 stainless steel trimmings and carbon steel bodies and bonnets.

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CARBON STEEL } 800 Pounds @ 750° F. 1500 Pounds Cold Non-Shock

For 150-800 pounds general service Union Bonnet • Ground Joint • Inside Screw Stem • Renewable Seat Rings • Solid Wedge — Slotted Type • 11½-13% Chrome Stainless Steel Trimmings Sizes ¼" to 2" inclusive.

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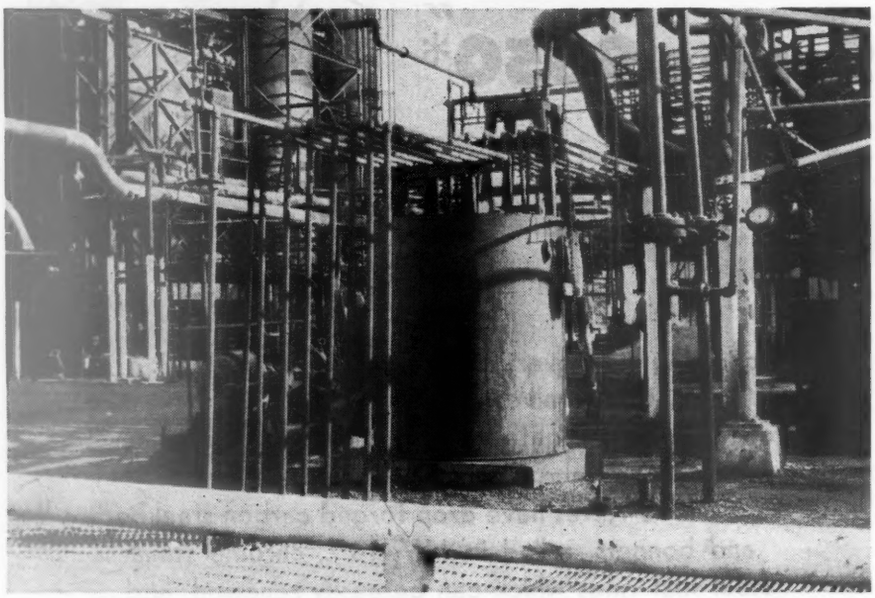
Treated Water Circulated Through Packing Glands

To prevent corrosion, keep scale deposition down to a minimum while maintaining the necessary low temperature in hot oil pump packing glands, the arrangement illustrated, to circulate treated water by using a closed system, to serve one or more refinery units has been installed. A centrifugal pump discharging into a header from which individual lines branch to the pumps and the packing glands, is used. Waste water from the glands is conducted through individual lines which lead the coolant back into a steel tank from which the circulating pump takes suction.

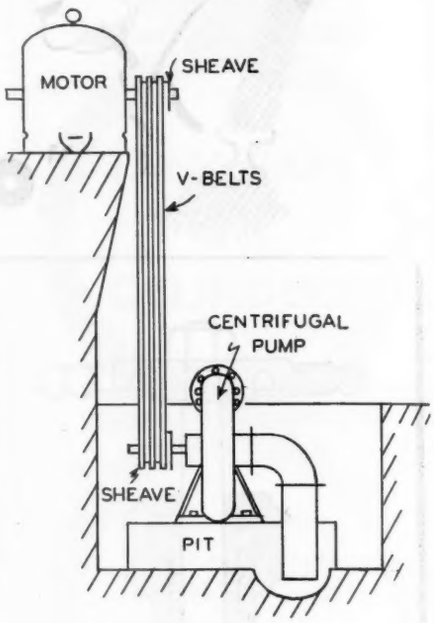
Piping can also be connected to water-cooled hot oil pump plungers with water of the same scale free characteristics as that commonly used in gas engine water jackets to maintain the original efficiency of the pump, which, obviously, reduces maintenance costs of processing.

Closed system to circulate treated water.



Remote Setting for Motor

To avoid the possibility of a flooded pump pit destroying an electric motor an engineer has worked out the successful assembly shown in the drawing. Mounted on "ground" level, at the edge of the pump pit, the motor is connected to the pump below by a multiplicity of V-belts of the proper length. Even though the belts are submerged in water-and-slush at the lower level they will not slip off the sheaves even if both are slippery.—W.F.S.



How to Compute Steam Flow Through a Pipe Without a Meter

Steam flow in pipes can be determined by the simple application of Babcock's well-known steam flow formula. The result will not always be 100 per cent accurate, to be sure, but in many instances it will be sufficiently accurate for an approximate test.

For example, an operator wishes to know the weight of steam that is passing through a certain pipe line. Select a straight run of pipe and tap two ordinary but accurate pressure gages into the pipe a known distance apart. The farther apart the better. Then, knowing the exact internal diameter of the pipe and the simultaneous pressure gage readings of the two gages, apply Babcock's formula;

$$w = 87\sqrt{\frac{p\,D\,d^5}{\left(1+\frac{3.6}{d}\right)L}}$$

Where:

w = the weight of steam flowing through the pipe in pounds per minute,

D = the density of the steam or weight in pounds of one cubic foot of steam at the mean average between the two gages,

p = the difference in pressure between the two gages in pounds per square inch,

d = the accurate internal diameter of the pipe in inches,

L = the distance between the two pressure gauges in feet.

For example, the pressure gages are placed on a one-inch pipe, 100 ft apart. One registers 5 lb and the other 15 lb pressure. How many pounds of steam are flowing through the pipe per minute? The pressure difference, p, is 10 lb.

To find D the "average" steam pressure must first be determined, which is, $(15 + 5) \div 2 = 10$ lb.

Steam tables show that at 10 lb gage pressure the weight of one cubic foot of steam is 0.0606 lb.

Next, the exact internal diameter of the one-inch pipe, as given in handbooks for standard pipe is 1.049 in. Substituting these factors in the formula we get the following expression the answer to which is 3.62 lb of steam per min.—W.F.S.

$$87\sqrt{\frac{10 \times 0.060 \times 1.049 \times 1.049 \times 1.049 \times 1.049 \times 1.049}{\left(1+\frac{3.6}{1.049}\right) \times 100}}$$

Catalysis Is Revising Refining Practices

THAT catalysis in its several applications is well on the way to revolutionizing the technology of the refining industry was indicated clearly by the discussions and papers given before the Western Petroleum Refiners Association in San Antonio, Texas, March 28-30. Foremost in this field as of today is the announcement of a new naphtha reforming process, the Platforming process (see Nelson, elsewhere this issue) using a very long-lived, rugged, and foolproof catalyst, platinum, which needs to be regenerated only now and then and which shows higher octane ratings and higher yields than any other reforming process or combination of processes. Details of the technology and engineering of the process will be disclosed soon, along with prospects, and presumably royalty rates and license features. The new process enables the refiner to obtain 90 per cent or more of reformed naphtha and to attain up to 95 Research octane number with 3 cc of TEL, a good "tool" to use, apparently, in the octane race to come.

New and greatly expanded specifications for jet engine fuels, just promulgated by the Air Materiel Command and discussed by C. R. Hudson of that service branch indicate that up to 50 per cent or more of the "average" barrel of crude can be made into satisfactory jet fuel, as contrasted with the 5 per cent yield obtained under the older, current specifications. The new requirements are: freezing point, not higher than minus 78 F; aromatic content, not more than 25 volume per cent; sulphur, not more than 0.5 per cent (wt.); gravity API, 45 to 63; Reid vapor pressure, 5.0 lb minimum, 7.0 lb maximum; gum, not more than 20 mg.; distillation range. 90 per cent, not lower than 400 F; endpoint, not lower than 600 F; bromine number, not greater than 30; heat of combustion, not lower than 18,400 Btu per lb. These specifications are expected to be printed within two weeks; both Navy and Air Force have approved them, it is reported from Washington.

With our present processing facilities it is possible for the refiner to choose from a large number of process routines to attain the products and qualities required in his individual situation, H. D. Noll and associates showed in discussing catalytic cracking and the application of the Houdriflow process to the refiners' needs. Earlier cracking processes employing catalysts have been simplified greatly into the Houdriflow method, in which a moving bed of catalyst is employed instead of the Houdry-pioneer fixed bed; instead of the TCC mechanical elevation system the regenerated catalyst is transferred by a current of air or inert gas or a mixture of the two, at much lower cost and with more advantages overall, Noll stated.

Hydroforming as a process for upgrading low octane number naphthas is proved to show a definite yield-octane number advantage over thermal reforming, N. H. McLaurin and collaborators told the technical refiners meeting. Thermal reforming is more economical for production of octane ratings up to 78 ASTM; above that value hydroforming becames slightly more economical. The two processes have the same order of economics for operating on sweet or sour stocks. Sour stocks show an advantage in yield-octane number relationships over sweet stocks. Operating on each stock with an alumina-molybdena catalyst, on sour stock with 0.421 per cent sulphur and on sweet stock with only 0.008 per cent sulphur, it was found that coking limit was reached at approximately the same dry gas yield (propanes and lighter). Throughout the conversion range the sulphur content of the hydroformate was almost constant at about 0.005 weight per cent; when thermal reforming the sulphur content varied with the conversion range.

Texas oil fields can produce at least 500,000 bbl per day more crude than is now being allotted, said Brig. Gen. E. O. Thompson of the Texas Railroad Commission, but has been cut back to correlate with demand. Therefore it was indicated that this country can and will meet all demands at least to that extent and that foreign crude imports should be cut back in line with that production ability. Thompson said outstanding progress is being made in the elimination of preventable waste from flaring field gas in Texas, and this waste has been reduced to a fraction of the amount burned a few years ago, it was stated.

New Officers

R. W. (Bob) McDowell, vice president of Mid-Continent Petroleum Corporation, Tulsa, was elected president of the Western Petroleum Refiners Association, to succeed H. T. Ashton, Socony-Vacuum Oil Company, Inc., who has been president since 1946. Vice presidents elected are: R. L. Tollett, Cosden Oil Company, Big Spring; F. L. Martin, Sunray Oil Company, Tulsa; H. E. Zoller, Derby Oil Company, Wichita, Kansas; Roland V. Rodman, Anderson-Prichard Oil Corporation, Oklahoma City. The four new directors are: W. J. Carthaus, Tulsa; Harry J. Kennedy, Ponca City; Brown Neece of Chicago, and M. H. Robineau, Cheyenne. John C. Day, Tulsa, was re-elected secretary-treasurer of the association.

Socony-Vacuum Further Expands Refining Rate

Capital expenditures of $60,000,000 for major replacement and expansion projects in six of its refineries have been announced by the Socony-Vacuum Oil Company, Inc. The projects, most of which were started in 1948, are expected to be completed this year at refineries in Brooklyn, New York; Paulsboro, New Jersey; Beaumont, Texas; Torrance, California; Casper, Wyoming; and East St. Louis, Illinois.

Domestic refineries of Socony-Vacuum set a record in 1948 when they processed a daily average of 472,000 bbl of crude oil. This is 12,000 bbl a day more than in 1947 and 60,000 more than in 1946.

Refineries in Frontignan and Gravenchon, France, and in Naples, Italy, processed an average of 19,000 bbl of crude a day, an increase of 8000 bbl daily over 1947. Major progress was made during the year in reconstructing these refinery facilities which were damaged during the war.

LPG Odorant

Oronite Chemical Company announces a new addition to its line of gas odorants, which is being offered especially for odorizing LP-Gas. Like natural gas, LP-Gas is odorless in its natural state and an odorant is added for public protection, to warn of leaks before an accumulation of gas may be exploded by an open flame or an accidental spark.

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. . . yes, nothing but an actual visit to this western control station can convey the sense of its sweeping beauty and painstaking construction.

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API Takes a Forward Look-See

Operational management and plain "good housekeeping," along with personnel training programs and conservation of products and byproducts occupied thoroughly the minds of the refining division members of the American Petroleum Institute at its 14th Mid-Year meeting at Houston, April 4 to 7. Outstanding in the full-to-overflowing program for the technical sessions was a 14-paper symposium on Rapid Methods of Analysis, bringing up to date the reports on progress in developing and applying methods that are time-savers to the industry; reduction of the time-lag between sample-taking and report of analysis or test results is of the greatest importance under the speeded-up refinery tempo of 1949.

Greatly accelerated efforts are being devoted to training of refining operating and other personnel; three separate papers at this meeting occupied an entire session; review of the recent report made by the committee on refinery training has shown that a large number of the smaller refineries have no formal training at all for employes and that many larger plants carry on programs that appear to be inadequate under postwar conditions. Corrosion called forth four reports of studies on hydrogen blistering of steels, hydrogenation-plant requirements in steels, cathodic protection and the effect of stress factors in failure of expansion joints; the last is an increasingly serious problem, on account of the rapidly increasing number of these joints installed, especially in catalytic cracking and its auxiliary units. Waste disposal received some careful attention; this is warranted, and forced on the refiner for two reasons, conservation of hydrocarbon materials and prevention of pollution of waters as demanded by national, state, county, and municipal authorities. The systematization of maintenance methods has been advanced by the requirements of, especially, the catalytic cracking unit and the necessity for time conservation. Preventive maintenance, cost reduction by more systematic scheduling and other subjects of prime importance in this field were discussed at considerable length by different technologists.

Design of a "community" oil separator unit to serve two large refineries has shown that up to 35,000 gpm of waste oil-water mixture, and as much as 10,000 gpm of rain water runoff may be handled easily in a unit including one distribution chamber and 20 final chambers, employing two-stage removal of oil and sediment for better separation. This unit is operated jointly by Pure Oil Company and Standard Oil Company (Ohio) at Toledo. The unit recovers 95 per cent of the oil found in the waste liquid, the reports stated. Numerous methods may be employed to dispose of waste chemical materials; spent caustic may be neutralized with spent acid and sludges, the released hydrogen sulphide burned, and the acid oils recovered by separation, L. C. Burroughs and R. W. Carnahan of Shell Oil Company say; flue gas may be used also to neutralize the caustic solution.

In hydrogenation operations 2600 psig is the upper limit of use of carbon steel for any purpose, G. A. Nelson of Shell Development Company finds after surveying the entire subject of hydrogenation and its demands on steels. Variations in making steel may change its performance greatly; some samples of carbon steel show good results at 350 psig and 590 F in contact with hydrogen, while others of the same approximate analysis were severely damaged. Even low alloy steels show great advantage in many cases, but the cost of equipment mounts rapidly; low alloy steel exchangers in one case cost three times as much as carbon steel units. It is believed that hydrogen corrosion is caused by formation of methane from carbon in the steel and the hydrogen, with resultant blistering at high temperatures, since the methane formed inside the steel cannot escape through the minute interstices. In ammonia synthesis nitriding begins at about 850 F.

Open West Coast Branch

Precision Scientific Company of Chicago, makers of scientific research and product control apparatus, has opened a branch office in San Francisco. Walter A. Blair has been placed in charge and will be located at 302 Hobart Building, 582 Market Street, San Francisco, 4.

Paddock Sales of Texas

Sales Agent for Paddock Engineering Company of Texas

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NEWS

European Refining Capacity

European refining capacity, which stood at 370,000 bbl per day at the close of 1947, may increase to as much at 520,000 bbl per day by the end of June if needed equipment becomes available, the Economic Cooperation Administration reported to Congress.

Because of the rapid increase in refining capacity, imports into the Marshall Plan countries of refined products during the first half of last year were held to the same level as in the corresponding period in 1947, while imports of crude jumped to 158,000,000 bbl during the period, compared to 123,000,000 bbl in the earlier year.

France is planning the largest expansion in refining capacity, with moderate increases scheduled in the United Kingdom, Holland, Italy, and bizone Germany.

Refinery Moving to Italy

The refinery at Longview, Texas, recently sold by Danciger Oil and Refining Company to W. C. Berry and associates of Tulsa, is being dismantled for shipment to Augusta, Sicily, under the European Recovery Plan. The refinery has not been operated since the end of the war.

Carlo Galetti, consulting engineer for the Italian Rasiam Refining Company that purchased the refinery, is in Longview to supervise dismantling and shipment. When rebuilt in Italy, the former Danciger plant will almost double Rasiam's refining capacity. It will process crude oil from the Middle East.

British Cracking Process

Petrochemicals, Ltd., recently placed on stream the first Catarole cracking furnace at its plant at Partington, near Manchester, England. From the beginning of operation the quality of the products, both liquids and gases, has been up to specification and the yield of the olefinic gases, which constitute the valuable part of the gaseous product, is higher than expected. The throughput is in excess of the rated capacity. Delivery of gases to the Manchester Corporation Gas Works has commenced.

It will be recalled that the Catarole process converts an essentially non-aromatic charging stock derived from petroleum into the full range of aromatic hydrocarbons, formerly obtainable only from coal tar, and into gases rich in olefins. The process is the first of its kind to be developed and is entirely a British invention.

Monsanto Plant Dedication

Monsanto Chemical Company's new Texas City plant was dedicated April 8, nearly two years from the day the styrene plant was destroyed by the explosion of the nitrate-laden *SS Grandcamp*. Highlight of the dedication was the unveiling of a memorial to the 145 Monsanto employes who lost their lives in the disaster.

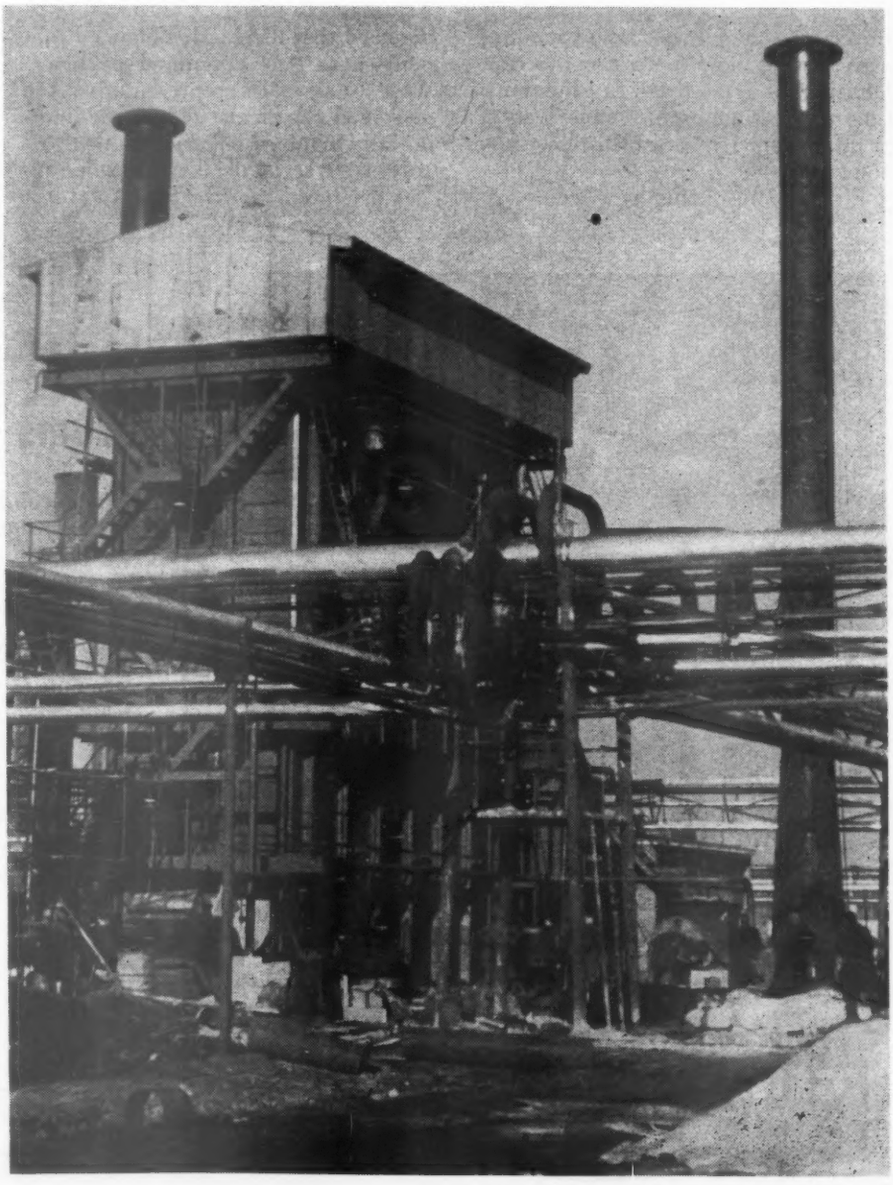
Following the dedication ceremony at which an address was given by plant manager, H. K. Eckert, out-of-town guests were invited to tour the plant. In the afternoon a symposium, dedicated to the new plant and the conservation of the petroleum and chemical resources of Texas, was held at the Shamrock Hotel in Houston.

In the evening a reception followed by dinner was held in the Shamrock. Karl T. Compton, director of the research and development board, U. S. Department of Defense, and chairman of the board of Massachusetts Institute of Technology, spoke on "Men and Ideas: The Objective and Resource of Our Scientific Educational Institutions." William M. Rand of St. Louis, president of Monsanto, and Warren S. Bellows, president of the Houston Chamber of Commerce, also addressed the group.

Micro-Chemical Analysis

The Texas Company has established a graduate fellowship in micro-chemical analysis at New York University, believed to be the only fellowship of its kind in existence. Purpose of the fellowship is the comparative study of methods for determining the presence of sulphur in organic materials by micro-chemical techniques.

Catarole cracking furnace at Partington, England.



NEWS

Egloff Address

Gustav Egloff, leading petroleum economist, was guest speaker at a dinner and technical session held by eight California societies and associations at the University of Southern California on March 31, He spoke on "Oil Technology and Motor Fuels."

Sponsors of the evening included the California Natural Gasoline Association, American Chemical Society, American Institute of Chemical Engineers, American Institute of Electrical Engineers, American Institute of Mining and Metallurgical Engineers, American Society of Civil Engineers, American Society of Mechanical Engineers and the Southern California Meter Association.

New Process Design Company

A new company, called the Rust Process Design Company, has been formed to take over the expanding activities of the Process Engineering Division of The Rust Engineering Company, Pittsburgh, Pennsylvania, S. M. Rust, Jr., president, has announced.

Formation of the new company will facilitate the handling of overall contracts in the fields of chemical processing and refining work.

Rust is currently handling the design and construction of two 25,000 bbl per day crude oil topping units for Petrol Refining, Inc., at Texas City, Texas, utilizing equipment from a war-time plant at Beaumont, Texas.

Exhibition Trailer

%Proportioneers, Inc.% has an exhibit trailer touring the southeastern states that displays full-sized operating equipment. Both public health applications and industrial applications are illustrated, the latter group including control of additives and blending of liquid ingredients by weight and by volume. The 5 tons of working equipment is operated by a self-contained 110-v a-c motor generator set.

Chemicals Representative

A. B. Hersberger, manager of the Chemical Products Division of The Atlantic Refining Company, announced that the L. H. Butcher Company has been appointed exclusive West Coast sales representative for packaged chemicals. The major items initially involved will include the "Ultrawets," a series of alkyl aryl sulphonates produced by Atlantic.

New Wax and Oil Solvent

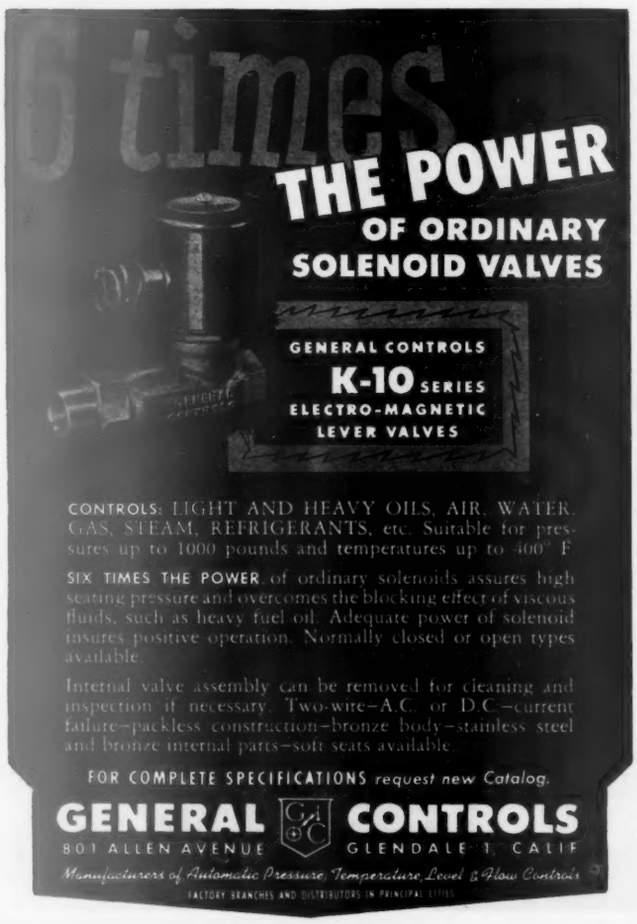
Visco VS, a new high-flash-point solvent for wax, grease, lube oils, paint, and fusible or soft resins has been announced by Visco Products Company, Inc., Houston, Texas.

The solvent is non-injurious to skin, non-corrosive, and will not injure surfaces of metal or wood. Having a relatively high flash point, it is much safer to use than naphtha or other low-flash-point petroleum solvents.

Lube Oil Patents

American Cyanamid Company, 1937 West Main Street, Stamford, Connecticut, has placed on the Register of Patents availabe for license on reasonable terms four patents presenting lubricating compositions especially adapted for heavy duty service.

The essential feature of the patents is the addition, to a mineral lubricating oil, of 0.5-1 per cent of polychlorinated naphthol (Pat. 2,161,560); diaryl dichlorethylene (Pat. 2,161,678); chlorinated stearone (Pat. 2,211,687); or chlorinated oleone (Pat. 2,284,258). In all patents oiliness and film strength of the lubricating oil are greatly increased. A further advantage is that all compositions are stable under heat and are not corrosive to metal.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SIX TIMES THE POWER of ordinary solenoids assures high seating pressure and overcomes the blocking effect of viscous fluids, such as heavy fuel oil. Adequate power of solenoid insures positive operation. Normally closed or open types available.
Internal valve assembly can be removed for cleaning and inspection if necessary. Two-wire—A.C. or D.C.—current failure—packless construction—bronze body—stainless steel and bronze internal parts—soft seats available.
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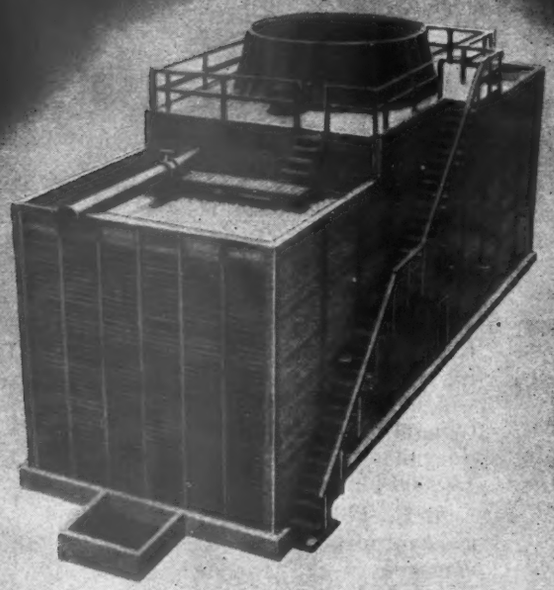

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STAIRWAY . . . DOUBLE-FLOW towers are equipped with a stairway built at the enclosed endwall of the tower. This eliminates fog envelopment and ice formation on stairways or ladders built over louvered sections. Operators do not have to climb high, dangerous ladders.

HANDRAILS . . . stairway and wide, level fan deck are guarded with high handrails. At no time is the operator at the mercy of high, gusty winds or in danger of inadvertently falling off the tower.

OUTSIDE WALKWAY . . . a short stairway leads to a walkway over each distribution basin. Water level may easily be adjusted or the basin cleaned. Complete flexibility of operation or maintenance is a result without the usual risks and dangers involved.

INSIDE WALKWAYS . . . through the interior of the tower, walkways enable the operator to observe water breakup, condition of structure, and operating conditions of the tower. This can all be checked while the tower is in operation without danger to the operator.

WALLED FAN CYLINDERS . . . each fan is enclosed with a fan cylinder . . . high enough for safety, low enough for easy inspection. And, there is plenty of room between the cylinder and fan deck railing for free movement without risk.

Tower owners and operators know that MARLEY DOUBLE-FLOW towers are SAFE TOWERS . . . safe in any stage of operation or maintenance . . . safe in any weather.

That's why more and more Safety Engineers of America's great industries are recommending MARLEY DOUBLE-FLOW COOLING TOWERS.

Ask for a MARLEY Factory-Trained APPLICATION ENGINEER to tell you more about the MARLEY DOUBLE FLOW Cooling Tower and its numerous SAFETY FEATURES. He'll be glad to help you solve YOUR water cooling problems. No cost or obligation.

MARLEY COOLING TOWERS

THE MARLEY COMPANY, INC. • KANSAS CITY 15, KANSAS

PERSONALS

▸ **C. F. Beatty,** a director of the Socony-Vacuum Oil Company, Inc., and formerly president of the Socony Paint Products Company, has been re-elected for a one-year term as a board member of the National Industrial Conference Board. Beatty started with the Standard Oil Company of New York at the Pratt Refinery in Long Island City, New York, in 1912. He became manager of the paint department in 1928.

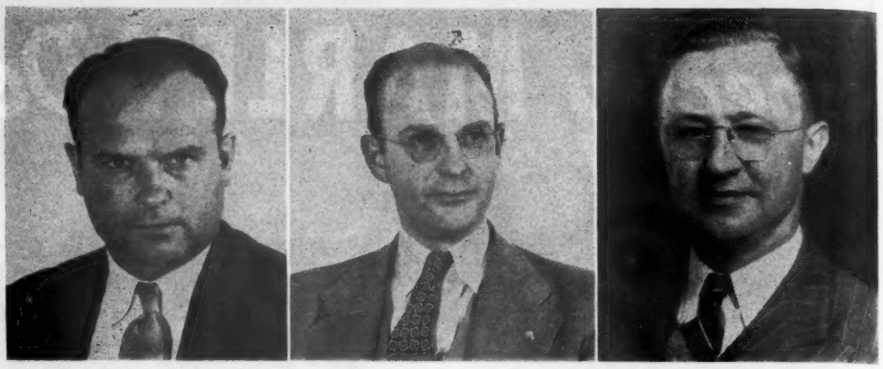
▸ **Joseph J. Mikita** has been promoted to director of the DuPont Company's petroleum laboratory, which functions as a unit of the technical division of the organic chemicals department and conducts research on the performance of fuels and oils in automobile engines. Appointment of the heads of three laboratory divisions also was announced. They are **Richard O. Bender,** chemical; **Milton H. Campbell,** engineering; and **Robert H. Hobert,** service.

Arthur F. Bowe was promoted to manager of the Eastern District laboratory of Du Pont's Petroleum chemicals division.

▸ **R. D. Hanley** has been elected a vice president of the Magnolia Petroleum Company. Hanley, manager of Magnolia's natural gas department and director of the company, began working for the Magnolia Gas Company in 1925 and five years later was transferred to the Magnolia Petro-

R. D. Hanley

leum Company as chief chemist of the natural gas department. In 1938 he was made general superintendent of that department and in 1942 was advanced to manager of the natural gas department. On January 1, 1948, he was elected to the board of directors of the Magnolia Petroleum Company. Hanley was graduated in chemical engineering in 1925 from Texas A. & M. College and since that time has been with Magnolia or an affiliate.



J. H. Curtis A. E. Thompson Randal Maas

▸ **James H. Curtis,** former manager of the General Petroleum Corporation's Torrance, California, refinery, has been appointed manager of refineries in the company's manufacturing department. In his new post Curtis will have general supervision of all General Petroleum refining operations that daily process an average of 130,000 bbl of crude oil.

A. E. Thompson, who has been assistant manager, succeeds Curtis as manager of the Torrance refinery. **Randal Maass,** refinery engineer at Torrance, becomes assistant manager.

Curtis came to General Petroleum in December, 1942, from The Lummus Company, where he was a process engineer in charge of the initial operations of newly constructed petroleum refineries. He became assistant manager at Torrance in 1944 and manager in 1945. He is a native of Salem, Illinois, and a graduate of the University of Michigan (1936).

Thompson joined General Petroleum in 1934 as an inspector after graduating from the California Institute of Technology. He advanced to chemical engineer in 1936, refinery engineer in 1943, and assistant manager of the Torrance refinery in 1945.

Maass joined the company in 1934 as a laboratory technician. He advanced to chemist in 1937, gas engineer in 1943, and refinery engineer later the same year. He graduated from the California Institute of Technology in 1932 and received his Master's Degree from the University of Southern California in 1936.

▸ **Clinton C. Steward** has been appointed chief engineer of the Ralph M. Parsons Company, Engineers and Constructors, of Los Angeles. He was previously associated with Parsons for several years starting in 1938, when Parsons was director of engineering of the Bechtel McCone Parsons Corporation of Los Angeles. Steward replaces **Elwood Layfield,** who has been moved to the new position of manager of engineering and construction.

▸ **Vice Admiral Earle W. Mills,** USN (Ret.), has been elected executive vice president and a director of Foster Wheeler Corporation, and **David McCulloch,** formerly executive vice president since 1935, has been named vice chairman of the board, it was announced by Harry S. Brown, president and chairman.

▸ **R. A. Andresen** has been appointed assistant chief engineer of the manufacturing department, Eastern Division, California Texas Oil Company, Ltd. Andresen, with headquarters in New York, will handle all refinery engineering and construction projects east of Suez and in the eastern Mediterranean.

After taking a B.S. degree in mechanical engineering at the University of California in 1935, Andresen joined the general engineering department of Standard Oil of California, as a process engineer. From 1938 to 1948 he spent the majority of his time on Bahrein Island as chief engineer of the Caltex refinery there, in charge of engineering, maintenance, construction, and transportation. Returning to New York in mid-1948, Andresen worked on special Caltex engineering projects until assigned to his new position.

▸ **Joseph J. Drucker,** mechanical engineer, long experienced in refinery construction, has been named manager of the estimating and cost control department of Catalytic Construction Company.

▸ **Charles W. Shaeffer,** who retired in June, 1947, as manager of the Socony-Vacuum Oil Company, Inc., refinery at East Providence, Rhode Island, has been named chairman of the board of managers of the East Providence branch of the Industrial Trust Company, succeeding the late Clarence H. Horton.

▸ **Ralph G. Caouette** has been appointed general manager of the Pittsburgh Equitable Meter Division of Rockwell Manufacturing Company.

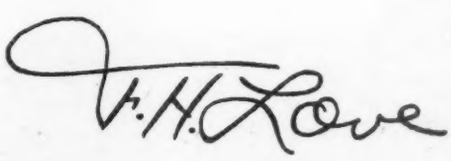
AN INTELLIGENT APPROACH

Shell Pipe Line Corporation is making a wise approach in the matter of training its personnel to operate the stations that are being constructed on the Ozark Pipe Line System between Cushing, Oklahoma, and Wood River, Illinois. Because the personnel may not be entirely familiar with the automatic and electrically driven equipment that is being installed, it was decided a training course should be given so that when the stations are ready to go on the line personnel will be ready to operate them.

The first step toward this end was the preparation of a training manual to present the basic principles of materials, energy, hydraulics, electricity, magnetism, and pneumatics that govern the design and operation of the line and station equipment; describing also the many items of equipment and explaining their practical operation. Preparation of the manual was by management and engineering personnel of Shell with a helping hand being given by the University of Texas in the matter of organizing and editing.

The manual has the general form of an extension course text, but instead of being presented by correspondence is taught by traveling instructors. Two members of the Shell organization were appointed to these jobs and they are conducting regular classes for employes one evening a week at each station. In due course a group of employes will be selected for the station jobs, the selection being based on seniority and the ability to understand and apply the material contained in the training manual. Arrangements will then be made for the employes to obtain practical experience in handling the new equipment before actual operation of the system begins.

This is an example of attacking a problem from a practical and intelligent viewpoint and unquestionably will result in efficient station operation from the outset.



Cook Graphite Iron Plain Rings feature: Excess carbon in the form of graphite flakes to ease the ring over dry spots in the cylinder—Porosity to facilitate spreading of lubrication—Rapid work-hardening ability to minimize friction, prolong life—Freedom from wear-inducing, steel-like inclusions (carbides).

"In three weeks, we're going to start reringing our big units at the rate of one a week," said the Chief Engineer. "We can't afford any delays. How fast is Cook on piston rings deliveries?".

"We'll meet any deadline you want to set," said the Cook field man, "even if we have to burn the midnight oil to do it!".

This was an actual experience — one of many that Cook's corps of trained engineers meet every day. And, we're happy to relate that the Chief got his deliveries in plenty of time to maintain his original overhaul schedule.

Not all delivery problems are as simple as this, but wherever possible Cook can and does provide operators with fast, prompt service on any industrial sized piston ring requirements. Cook does this by maintaining a large stock of standard size rings for immediate delivery and by providing rapid processing of special orders for quick shipment. Streamlined facilities—new production methods—and fast modern equipment make this possible.

Yes, you can rely on fast delivery from Cook, just as strongly as you can rely on better performance, longer life, and less cylinder wear from Cook Graphitic Iron Rings. Thus, if you need piston rings, either now or in the future, it will pay you to get in touch with Cook. A call or a letter to the office nearest you will do.

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Clamshell digs trench across creek. These and backhoes also were used to help make ditch in rocky areas.

Initial Stage Michigan-Wisconsin Line

FRANK H. LOVE*

EXCLUSIVE

AN initial construction stage on the Michigan-Wisconsin Pipe Line Company project was completed with the laying of pipe as far as Marysville, Missouri. This represents 457 miles of the 1160-mile line from Hugoton field to distribution points in the states of Michigan and Wisconsin. A notable feature is the fact that the system will take natural gas into Wisconsin for the first time.

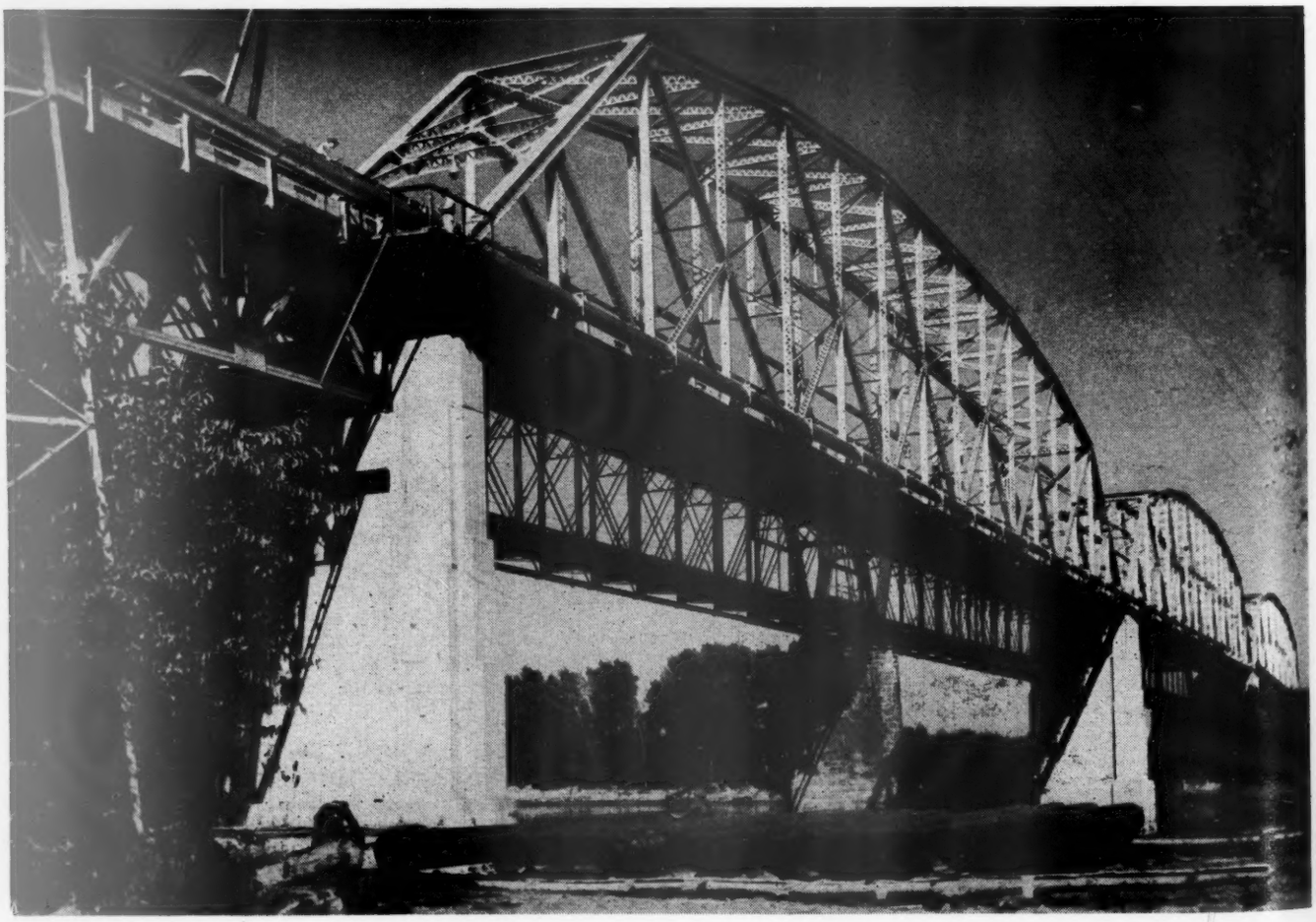
The entire project, which will include distribution laterals in Wiscon-

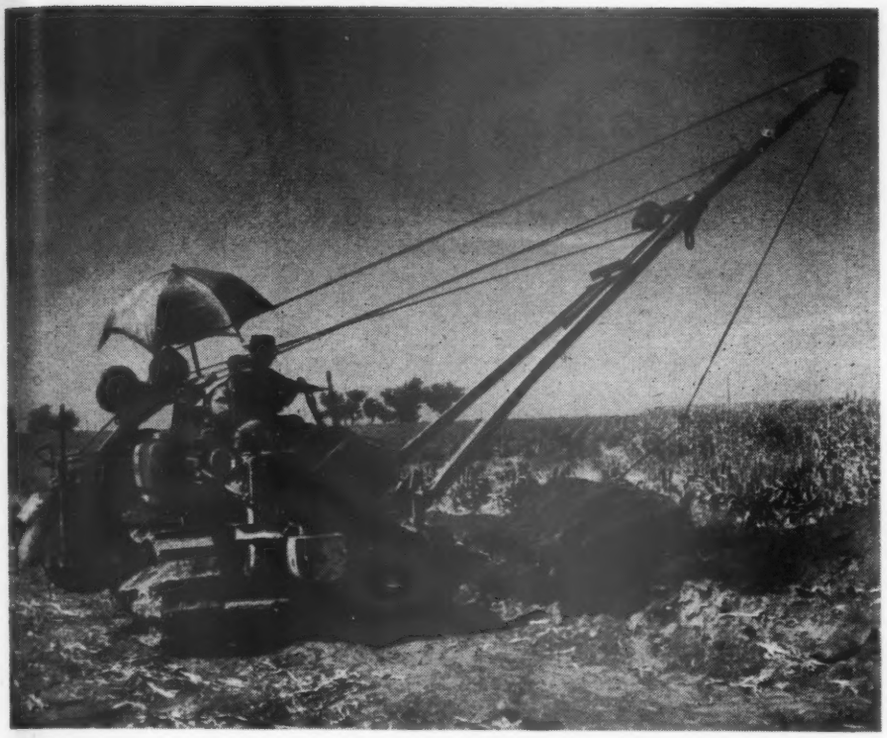
*Editor, Pipe Line and Marine Transportation.

Welder makes a finish weld on pipe joint. Four beads were run on each joint.

Stringing pipe along the right-of-way through Kansas. Boom tractor lifts high a joint of 24-in. pipe before placing it gently on the ground. Handled in this manner the pipe is seldom damaged.

By special arrangement with the state highway department the pipe line crossed the Missouri River at Rulo, Nebraska, on a highway bridge as shown here. The pipe rests on rollers to provide for contraction and expansion. The pipe was welded a joint at a time and pushed into place. This manner of crossing saved the expense of an overhead suspension bridge or an underwater crossing.





Backfilling and cleaning up the right-of-way after pipe has been placed in ditch is an important part of pipelining. In time the fill will settle, crops or grass grow back, leaving no indication that a pipe line runs underneath.

sin in additon to the above mainline, is expected to be completed and in operation "sometime" during 1950. Already some delay has been occasioned by one of the crews running out of pipe, and although procurement of pipe is expected to be easier during the current year, it is still impossible to pin down the concluding date to any particular month.

The line laid thus far has been of 24-in. pipe and this same diameter pipe will continue to what is termed Wisconsin Junction, a point near Sandwich, Illinois. From there a 22-in. line will skirt the area south of Lake Michigan and up the east side of the lake to the Austin field, Michigan. This field, as well as two other interconnected areas (Goodwell and Reed City) will be used for storage, gas being injected during the summer months of reduced demand and withdrawn during the winter period for movement to Detroit. Already a pipe line has been laid to Detroit by the Austin Field Pipe Line Company, an affiliate of Michigan-Wisconsin Pipe Line Company. This project was completed in the summer of 1948 and the difficulties of laying the line under adverse weather conditions, which included blizzards, frozen ground, and floods, have been described previously in *The Petroleum Engineer.**

Three Construction Spreads

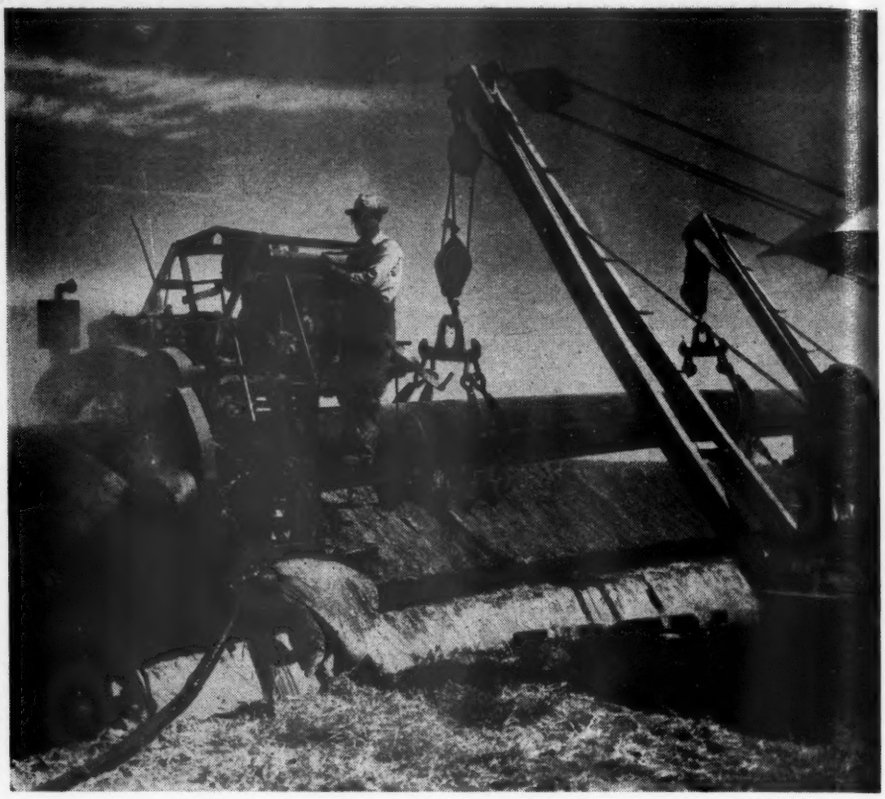
Work began on the Hugoton-Maryville segment last June 1 with three construction spreads operating out of Meade, Manhattan, and Holton, Kansas. The No. 1 spread, making headquarters at Meade, laid the first 275

*"Pipe Line Crews Battle Blizzards, Floods," Hal Fry, The Petroleum Engineer, July, 1948.

When a joint of pipe is being lined up for the tack weld there is real activity. This is the method known as stove-piping. The finishing welders are not far behind.

miles of the line; the No. 2 spread, working out of Manhattan, laid the next 78 miles, and the No. 3 spread, with headquarters at Holton, laid 104 miles. A considerable part of the work was finished last Fall, but, due to the delay mentioned, the entire section into Maryville was not completed until the early part of this year.

Originating at the Hansford plant of Phillips Petroleum Company in Hansford County, Texas, south of Guymon, Oklahoma, the line extends northeastward. Through the plains of western Kansas the construction crews experienced favorable conditions of weather and terrain and the "going" was easy. Approximately 50 miles of quicksand was encountered in the vicinity of the Arkansas River, however, and this presented a condition of caving ditch that had to be coped with. Through central and northeastern Kansas about 100 miles of rocky hills were traversed. This area is the famous flint hills of Kansas and to make ditch required extensive blasting and the liberal use of backhoes and clamshells to clean out the trench after conventional ditching machines had removed as much of the rock as possible. The rest of the right-of-way into Marysville was through rolling hills and soil conditions were excellent.



Coating and wrapping with traveling type machine. Hot enamel was applied to a thickness of 3/32 in. and wrapping was with both glass fiber and asbestos felt.

The line traverses about 100 miles of the flint hills of Kansas, which required extensive blasting. This crew is drilling holes in the rock and setting powder charges.

The line thus far has been coated and specifications call for coating throughout its entire length. Hot enamel was applied to a thickness of 3/32 in. in the field and wrapping was with both glass fiber and asbestos felt. Four beads were run on each welded joint and each spread included 18 to 20 welders and electric welding machines.

The initial station on the system, approximately 13 miles south of Guymon, is expected to be completed this summer. Most of the materials are on the site now. A dehydration plant also is to be built on the plant site.

Subject to approval of the Federal Power Commission, the ultimate number of stations on the system may total 15. This program, however, would cover a period of several years.

Contracting Firms

Ford, Bacon and Davis, Inc., of New York City, is the engineering firm for the overall project, and opened offices in Kansas City, Missouri, for this particular job. The initial compressor station is being constructed by a wholly owned subsidiary of this company, Ford, Bacon and Davis Construction Corporation. J. R. Horrigan Construction Company, Houston, Texas, is the contractor for laying the line. For Horrigan, Ben Law is the general superintendent. Spread No. 1 had as its foreman M. E. Shifflet; Spread No. 2, Louis Viscentine, and Spread No. 3, J. E. Flannagan. ***

EXCLUSIVE

At right is a view of the automobile shop with the car shed to the left. Below is the interior of the shop from the mezzanine floor.

Natural Gas Service Center

ROBERT M. HUTCHISON*

IN a rapidly growing city, such as Houston, Texas, the public utilities could not possibly escape growing pains, and as gas connections became more and more in demand it was very evident that bigger and better service quarters were needed if the Houston Natural Gas Corporation were to maintain its reputation.

Plans for a service center were made more than ten years ago but the war and other hurdles prevented its construction, although the company did procure a 10-acre site on Lockwood Drive in anticipation of the time its plans could be carried to completion.

When the war ended the drawings and specifications were taken from the files and subjected to careful study; because materials were exceedingly hard to get and prices were getting higher by the minute. Then, too, it was difficult to decide just how large the proposed buildings should be, for Houston Natural had grown from a 30,000 meter company in 1933 to an 83,000 meter one in 1946 and the end was by no means in sight.

Thus with a 300 per cent growth in prospect during the next 13 years, it took some tall pencil sharpening to know just where to stop. In fact, the company procured its 100,000th meter almost a year before the Center was ready for occupancy, thus proving that the designers had not been too optimistic of the future.

The final plans called for the erection of four buildings so arranged that each could be easily enlarged when the necessity arose.

The warehouse and meter shop are under one roof, although separated by a brick wall and fire door. Each is 60 ft by 150 ft with overhead clearance of 11 ft 8 in. The building has steel framework with Galbestos siding and the roof is composed of Masonite sheets attached to the structural steel members, such sheets being covered with a 2-in. layer of Pyrofill over which has been laid a 20-year bond tar and gravel roofing.

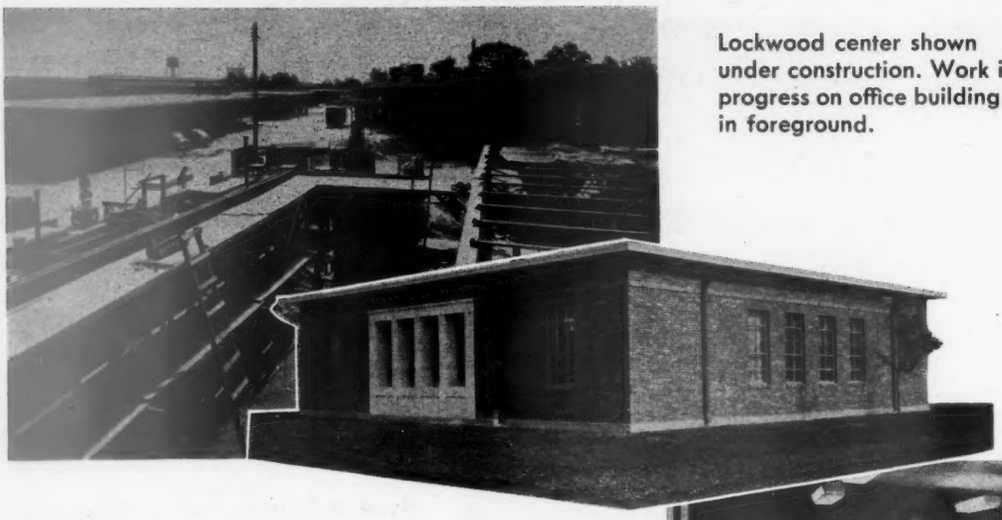
The concrete floor level in this building is about 3 ft above the drive, or just about truck bed height. A 21-ft canopy extends along a 7-ft loading platform the entire length of the warehouse section and over an 85-ft platform of the meter shop. These canopies have a clearance of 14 ft 6 in. and can be used as car shelters at night.

An office, a tool room, and a men's washroom have been provided in the warehouse and steel bins have been obtained for storing materials.

The meter shop contains an office, a meter proving room, a meter paint room, a laboratory or work shop, and a row of steel work benches. Bins and cabinets have been provided for storing spare meter parts, and there is ample space in the building for the storage of all sizes of meters.

The appliance storage building,

*Director of Safety and Research, Houston Natural Gas Corporation.



Lockwood center shown under construction. Work is in progress on office building in foreground.

Outside view of completed office building and below, dispatcher's office inside the building.

Mater proving room situated in center of shop.

Work benches in meter shop building.

Work shop and laboratory in meter shop building.

Below is meter paint booth in room built for that purpose.

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RESPONSIBILITY
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HIGH PRESSURE *incoming gas lines with Crane 12-in. Ferrosteel gear-operated double disc gate valves.*

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That's why oil men the world over turn to Crane. They know that the production and transmission of oil calls for good piping—and plenty of it. They also know that Crane offers them, in one catalog, the world's most complete selection of valves, fittings, pipe and accessories . . . in brass, iron, steel and alloys. That one order to Crane—through Branches and Wholesalers—gives a fast start to any petroleum piping job.

There are clear-cut advantages in standardizing on Crane. It's a **Single Source of Supply** complete enough to simplify every piping procedure, from design to erection to maintenance. **One Responsibility** for materials helps you to get better installations, avoids needless delays. And **High Quality** in every item in the Crane line assures most efficient performance from every part of piping systems.

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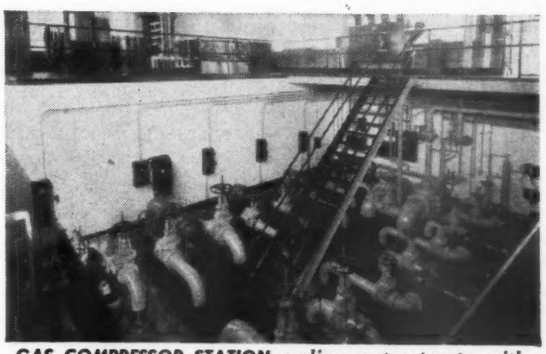
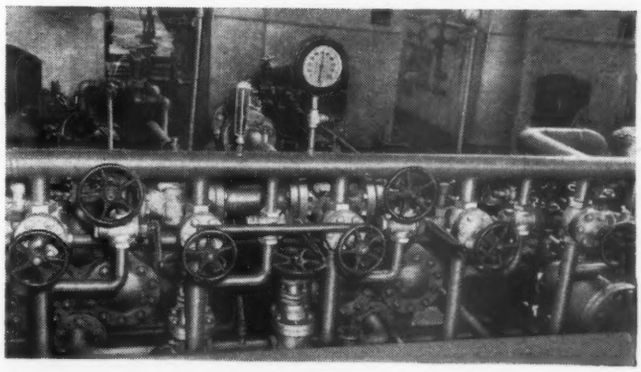


GAS COMPRESSOR STATION *cooling water pumps with Crane wedge disc and double disc gate valves. Also flanged and welding fittings from the complete Crane line.*



BOILER CONTROL MANIFOLD *on record depth well, using Crane brass, iron and steel piping equipment.*

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FOR EVERY PIPING SYSTEM

which is also 60 ft by 150 ft in size, is situated in line with the warehouse and meter shop, is of the same type construction, and has a 21-ft by 64-ft overhanging section. The floor of this building also has been raised to truck bed level.

Ample space has been provided for the storage of appliances and spare parts and provision has been made for an office, a paint room, and wash rooms.

The pipe rack is situated a short distance from the appliance building and is circled by a hard surface roadway. Floodlights have been erected to facilitate the handling of pipe at night.

The pipe is stored on concrete grade beams, capped with creosoted lumber, the beams being spaced to accommodate different lengths of pipe.

Gravel has been placed between grade beams the full width of the rack to insure good footing in bad weather.

A railroad spur extends the full length of the property on the north side adjacent to the pipe rack, the appliance storage building, the meter shop, and the warehouse.

The automobile shop is 62 ft by 137 ft with an overhead clearance of 16 ft. It is constructed of steel with Galbestos siding and roof.

There is a large, well lighted paint room, a washroom equipped with pressure pump and water heater, and a mezzanine floor over the wash room that is used as an office and for spare parts.

An overhead electric trolley extends the full length of the building and three disappearing car lifts have been placed in the concrete floor. It may be of interest to know that the lifts have all been cathodically protected underground with magnesium rods.

Spare parts department and office in appliance building.

The car shed, which is attached to the automobile shop, has steel framing and is covered with a Galbestos roof.

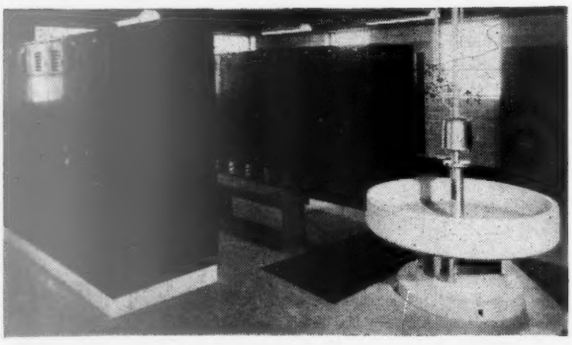
The floor is hard surfaced and there is room for 22 pick-ups and 12 large trucks.

The office building has steel framing, brick walls, and a Pyrofill roof. There are slightly more than 3000 sq ft of floor space in this building that is being used for offices or report room, and 1320 sq ft of floor space divided between the locker room and the tile bathroom. This building is completely air conditioned by two 5-ton air-conditioning units.

The roadway specifications call for a 6-in. concrete strip 20 ft wide to extend the full length of the buildings and to circle the pipe racks, with an apron extending to the loading docks of the service buildings.

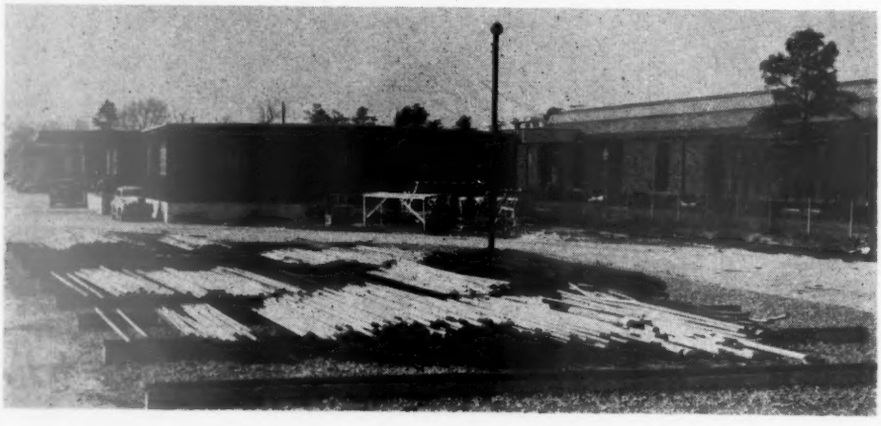
The concrete strip is flanked with a roadway of 8-in. compacted cement stabilized shell with a 1½-in. topping of asphalt-coated shell. This type of roadway also extends into and along the automobile sheds.

The entire property is enclosed within a 7-ft cyclone type fence, with gates placed at the point where the spur track enters and at the entrance on Lockwood Drive.



Locker room in the office building.

View of pipe racks with other buildings in the rear.



The ground for the new service center was broken on November 1, 1947, but due to unavoidable delays of one kind or another, the buildings were not ready for complete occupancy until the middle of December, 1948. The night of Saturday, December 18, was chosen for the formal opening, and the event proved to be a triple header celebration.

Frank C. Smith, company president, on that date in a very impressive dedicatory service attended by company employes, their families and friends, officially presented the key to the center to Vice President E. S. George, and the new plant was on its way.

Acknowledging the wisdom of the old Chinese saying, that "A picture is worth a thousand words," a set of photographs showing the most important features have been made a part of this article. * * *

Electrification of Petroleum Pipe Lines*

By M. A. HYDE, Westinghouse Electric Corporation

PART 1

There is a significant increase in the use of pipe lines for the transportation of petroleum products from the refining centers to important marketing areas. Numerous products lines have thoroughly demonstrated this method as the economic way of handling large shipments of liquid petroleum products on overland routes to centers of stabilized demand. The result has been consistent growth in such facilities and it is not difficult to envision future distribution of refined products by pipe line to every sizable inland community.

▸ **Electric power.** In recent years pipe line projects in the United States have shown a marked trend toward electric power. This is due to constantly increasing availability of electric service and to widening appreciation of the advantages of electric power from the standpoints of low investment in station equipment, low maintenance and attendance costs, reliability, and effectiveness of control.

▸ **Motor applications.** The pumps used on crude oil and products lines are of both reciprocating and centrifugal types. Reciprocating pumps may be driven by squirrel cage induction motor through gear or other means of speed reduction, or by low speed synchronous motor applied directly to the pump pinionshaft.

Except when pumping high viscosity oils, particularly through smaller lines, centrifugal pumps are used predominantly for crude and products lines, because of lower initial cost, smaller building space requirement, mechanical simplicity and inherent limitation of the pressure developed in the unit. Drive is ordinarily by squirrel cage induction motor, coupled, at 1800 rpm or at 3600 rpm on 60-cycle power supply. In selecting the speed it is necessary to consider the combined cost and performance of motor and pump for the specific requirement. The pump may be less expensive at 3600 rpm but the opposite is usually true for the motor.

The advantages of pipe lines for the overland transportation of petroleum and its refined products, while known to the industry for many years, were most strikingly demonstrated during World War II. In that critical period of transportation shortage, existing and new lines formed a vital part of an integrated transportation system to make petroleum available where needed. During the five years 1941 to 1945, inclusive, the mileage of trunk crude oil and products lines in the United States increased by about 13,000 miles to a total of 85,000 miles, not including some 57,000 miles of gathering lines.

Naturally, some of these facilities have undergone modification to meet changed postwar needs. Among these are the 24-in. crude line and the 20-in. refined products line, familiarly known as "Big Inch" and "Little Big Inch."[1,2] These two lines delivered as much as half a million barrels per day of crude oil and refined products from Texas to the New York and Philadelphia areas. They did this with electric power, requiring only 5 cents worth of electric energy to move each barrel over the 1400-mile course. These lines are now in service as natural gas carriers. They are being equipped to deliver 433,000,000 cu ft per day of much-needed Texas gas to the eastern areas. And in the performance of this task, too, electricity will play a preponderant part. For driving centrifugal compressors on this project, 1250-hp motors available from the 20-in. products line will be supplemented by larger motors now under construction, to a total of at least 117,000 hp in electric drive.

With all the additions made during recent years present pipe line facilities are inadequate. New lines are planned years ahead and their construction is proceeding at a rate limited only by the availability of steel pipe.

Table 1, which summarizes an estimate[3] of the pipe line construction program for the 1947-1951 period, shows that projects completed, under construction, and announced, will add to existing pipe line facilities a mileage equivalent to more than once around the world.

TABLE 1. Pipe line construction program, 1947-51.

Project location	Type lines	Mileage
United States	Crude oil	7,600
United States	Products	5,300
United States	Natural gas	10,900
Outside United States	All	5,200
	Total	29,000

In gas transmission, the use of centrifugal compressors driven by squirrel cage motor is becoming more common with the development of suitable compressors. The major installations to date operate at 3600 rpm with coupled drive. Step-up gear drive to compressor speeds above 3600 rpm have been used in other applications and are a future probability in gas transmission.

The applications just outlined seem at first glance to be so simple as to warrant no further discussion. That would be true if pipe lines were always operated at maximum capacity, at uniform capacity throughout the line length, handling fluids of constant viscosity and specific gravity. For these conditions the constant speed motor would be ideal. But in crude and products lines, particularly modern lines with no "breakout" tankage at the booster stations, problems are introduced by operation at part capacity, by deliveries made at intermediate points, by variations in the pressure-flow characteristic of the line due to change in viscosity of the pumped liquid, and by variations in operating pressure when handling liquids that differ in specific gravity and viscosity.[4]

To meet these variations in operating conditions—and at the same time hold the pressures along the line within the limits established by economic design—imposes the necessity of controlling the station output pressures. Speed control of the pumps is an obvious answer, but by and large it is not the economic one.

▸ **Line operation at partial capacity with constant speed pumps.** Operation at partial capacity is practical with constant speed motors throughout the line, if the number and size of pump units is advantageously chosen. Usually the pressure to produce the designed flow through the line is applied at several stations along the line rather than at a single station at the source. The total applied pressure is the sum of the several station pressures, and the latter are held to values

*Presented before American Institute of Electrical Engineers, Mexico City, Mexico, 1948.

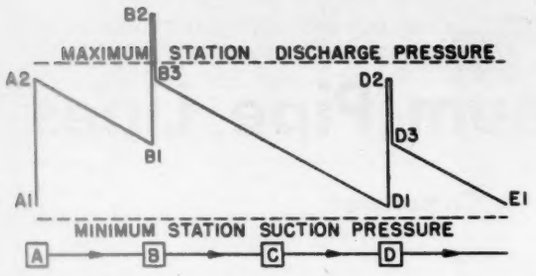


FIG. 1. Pressure gradient for a pipe line with four stations on level terrain.

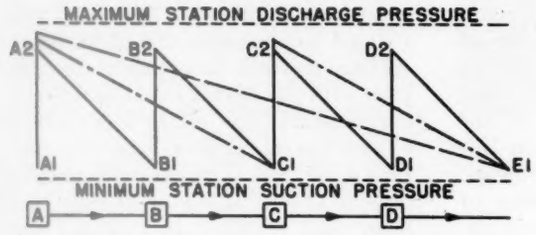


FIG. 3. Pressure gradient for four-station pipe line with third station out of service; excess pressures throttled.

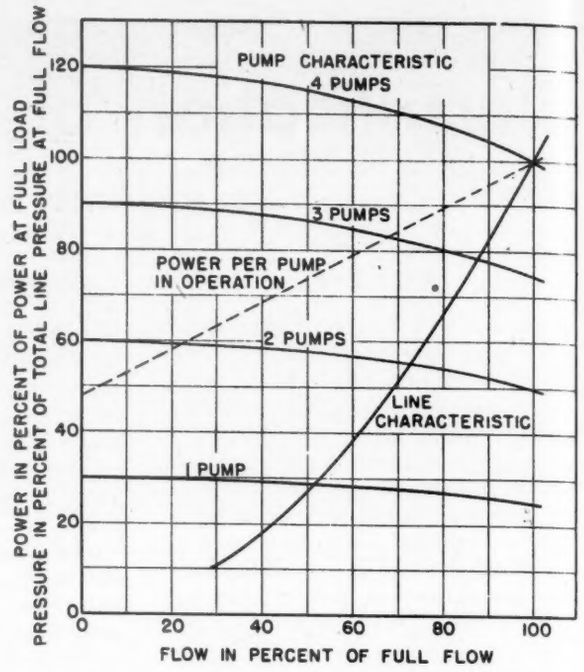


FIG. 2. Pressure-flow curves for pipe line with four stations each containing one centrifugal pump.

economical from considerations of pipe and equipment design.

Consider a pipe line over level terrain, with four stations, A, B, C, and D, each consisting of a single constant speed pump developing, at full flow, pressures A1A2, B1B2, C1C2, and D1D2 as shown in Fig. 1. The pressure gradient line between stations is A2B1, B2C1, C2D1, D2E1.

Now consider operation of this pipe line at reduced capacity. The total pressure applied to the line varies approximately as the 1.85 power of the flow, and the hydraulic horsepower as the 2.85 power of the flow. Therefore in a period when the line is required to transport less than full capacity, it is most economical to operate continuously at the lowest flow that will deliver the required throughput over the period, rather than to operate at some higher rate for a portion of the period and shut down for the remainder.

Fig. 2 shows a typical pressure-flow characteristic for the pipe line represented in Fig. 1, along with typical pump characteristics for the four identical stations operating in series to deliver 100 per cent pressure, resulting in 100 per cent flow. Also shown is a line representing the approximate power consumption at various flows for each pump operating.

The pipe line may be operated at reduced capacity by shutting down stations B and D leaving stations A and C in service, operating at a flow of 73 per cent and pressure of 54 per cent. Stations A and C are now operating at slightly higher pressure than they did when the line was carrying full flow. The pressure gradient in Fig. 1 becomes A2C1, C2E1. The power per barrel per day is $25 \times 86 \times 2/73 = 59$ per cent of that at full flow.

A still lower flow rate may be obtained by leaving only station A in service, operating at 52 per cent flow and 28 per cent pressure, the pressure gradient in Fig. 1 becoming then A2E1. The power per barrel per day is $25 \times 75/52 = 36$ per cent of that at full flow.

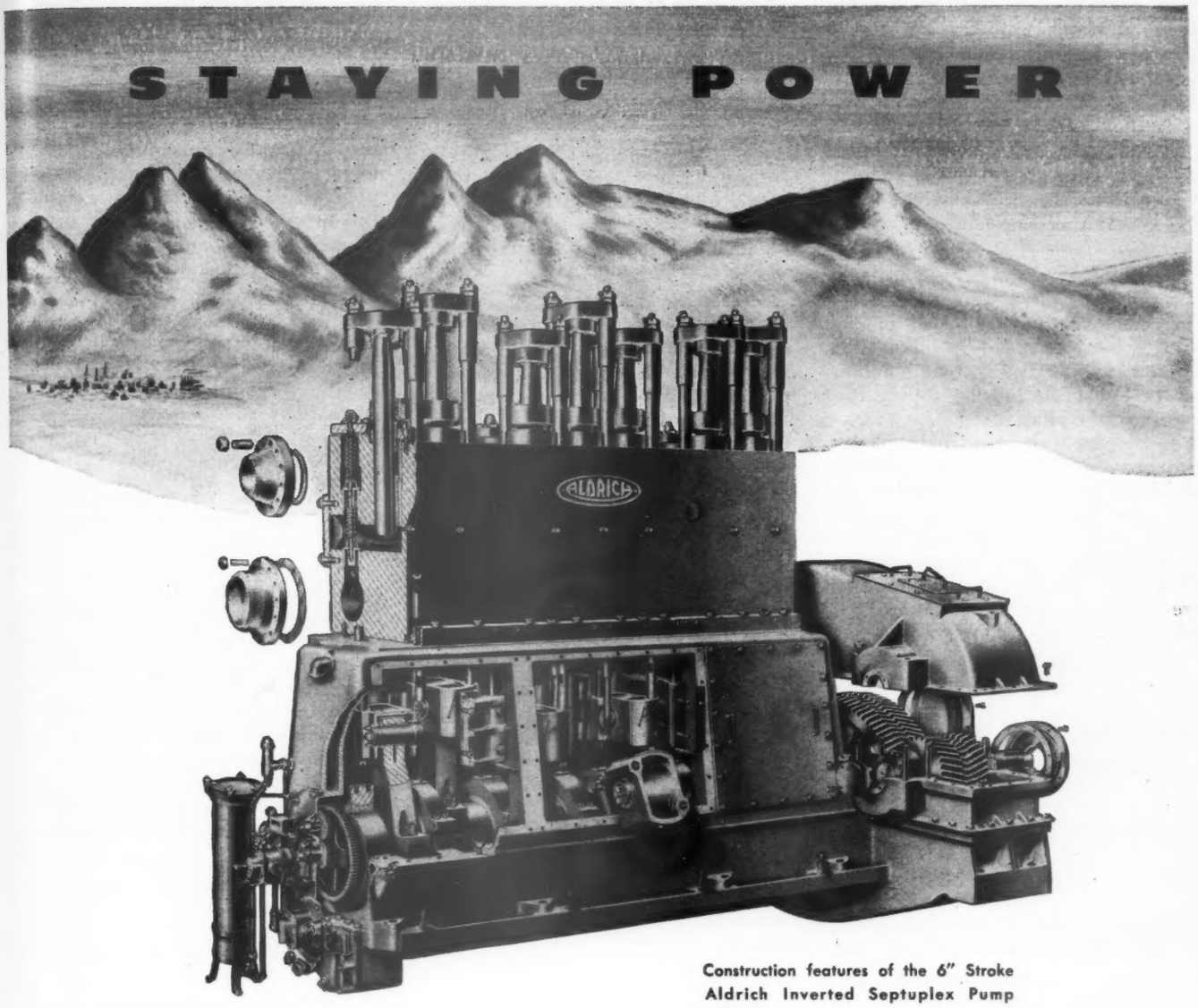
In practice, ability to operate on these or any partial-capacity gradients is contingent upon the gradient line clearing any local high points in the pipe line. It is also necessary that the maximum pressure at the discharge of any station be within the allowable working pressure established for the pipe, and that the suction pressure at any station be above the low limit established for safe pump operation.

Suppose now that station C is out of service and it is desired to operate the line at maximum possible capacity. This can be done by operating stations A, B, and D as shown in Fig. 3. At station B excessive line pressure is avoided by throttling pressure B2B3, also at station D throttling is introduced to dissipate excess pressure D2D3. The total pressure effective on the line is then equivalent to that of two stations with resulting flow rate and gradient the same as for Fig. 1. Even throttling half the pressure at two stations, the power per barrel per day is $25 \times 86 \times 3/73 = 88$ per cent of that for full capacity operation, compared to 59 per cent for the same flow when stations A and C are operated without throttling. Of course, power is only one component of the total cost per barrel transported, and the most economical operation is not determined by the minimum power per barrel.

It is evident from Fig. 3 that if each station consisted of two pumps in series, then stations A, B, and D could be operated at the same flow rate by taking one unit out of service at stations B and D instead of throttling the excess pressure at these stations. Subdivision of the total stations pressure into two or more series units also provides operating steps intermediate to those obtainable by "skip station" operation.

This practice has been extended to the employment of as many as three main units of identical characteristic, plus one or more units handling the station throughput at reduced head. A 22-in. crude oil line under design at time of this writing will employ six stations consisting of three full-head units each driven by a 1250-hp squirrel cage motor. Each pump develops approximately 240 psi under rated

STAYING POWER



Construction features of the 6" Stroke Aldrich Inverted Septuplex Pump

Every oil field, pipe line and refinery man knows that an oil industry pump must have *staying power*—the ability to maintain top performance and high efficiency over a long period of time. Interruptions or breakdowns cost. *Staying power* pays. And Aldrich Pumps have that staying power.

Consider a certain 232 mile crude oil pipe line in Wyoming. This line crosses the south hills of Big Horn Mountain at 6,328 feet, drops to 4,320 feet, traverses ridges of over 6,200 feet, spans the Shoshone River Valley, then rises again to the oil field. Two Aldrich Pumps are installed on this line to provide the pressures and capacities necessary to meet these pumping requirements.

Take a look at the Aldrich design and construction that make such rugged service easy. The 6" Stroke Septuplex Pump shown here is but one of several types built specifically for petroleum service. And all Aldrich Pumps are just as well built. For assistance in selection of the Aldrich Pump to fit your need, write now to:

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flow conditions, or 720 psi for the three pumps in series. Each station will also include a half-head unit to develop 120 psi handling full station flow. Three full units will operate normally, but at times two full units and one half unit will be used, or other combinations. This arrangement makes available seven pressure steps per station, using constant speed motors.

A similar arrangement of constant-speed pumps on a refined products line employs three full-head pumps each driven by a 200-hp motor and developing 320 psi, in combination with a half-head unit developing 160 psi, thus providing seven steps of station pressure with a maximum of approximately 1120 psi at a throughput of 18,600 bbl per day of gasoline. In this case the half-head unit consists of two pumps in parallel, each driven by a 60-hp motor. At rates below 12,000 bbl per day, the 60-hp units are used in series combinations for more efficient operation.

It is evident that numerous combinations of full-head and part-head units can be laid out to give multiple steps of station pressure. For a given total station capacity there is an economic limit to the extent of subdivision, as reflected in increased total cost of pumps, piping, valves, motors, and control. More than five pumps per station would probably not be justified in any case. The number of different ratings should preferably not exceed two for a pipe line having uniform capacity throughout its length.

With three pumps per station in two ratings, five steps of station pressure can be obtained by installing two full-head pumps and one half-head pump, all operable in series, as shown in Fig. 4.

Ten steps of flow may be had by operating these stations in pairs with the pumps scheduled to give pressure steps of one half-head unit per pair of stations. Thus full flow is attained with 2½ units in service at all stations. For the first step of flow reduction, stations 1, 3, 5, etc., operate 2½ units while stations 2, 4, and 6, etc., operate two units, an average of 2¼ units per station, under which condition the effective head is 92 per cent and the flow 95 per cent. The second step of flow reduction is with all stations operating two units, and so on down.

Under this schedule the first step of flow reduction imposes a pressure slightly higher than the normal pressure for 100 per cent flow at stations 1, 3, 5, etc., where all pumps are in service but at less than full flow.

The amount of excess pressure is minimized by installing pumps having a relatively flat head-capacity characteristic. It is usually feasible in pump design to hold the pressure rise within 20 per cent from rated flow to shut off. With such a pump characteristic the 10-step schedule outlined above involves a maximum pump pressure of only 103 per cent full flow pressure, this pressure being developed in stations 1, 3, 5, etc., and only on the first step of flow reduction.

It is evident from these cases that constant speed pump drives can be adapted to a wide range of line flow rates, providing small increments of flow, and requiring little throttling action.

It is always desirable to operate with minimum throttling, for the throttled pressure represents a proportionate part of the pump input power that is not utilized in the line. However, the station throttling valve under suitable automatic pressure-limit control has been a very useful feature on many pipe lines. The control system commonly employed automatically introduces throttling to prevent a rise of the station discharge pressure above the established upper limit, and also introduces throttling to prevent a fall of the station suction pressure below the desired minimum. This control system is also useful for bringing a

FIG. 4. Pressure increments for station consisting of two full-head pumps and one half-head pump.

PUMPS IN SERVICE	EFFECTIVE HEAD IN PERCENT OF HEAD AT FULL CAPACITY	FLOW IN PERCENT OF FULL CAPACITY
2-1/2	100	100
2	83	90
1-1/2	65	79
1	45	65
1/2	24	45

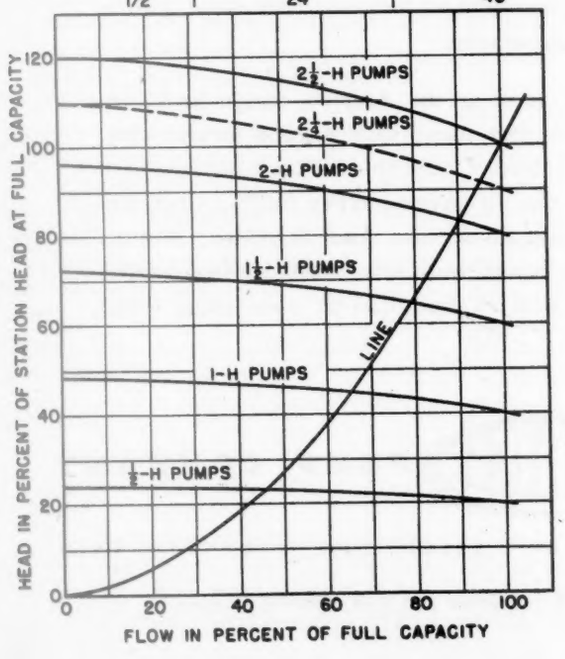
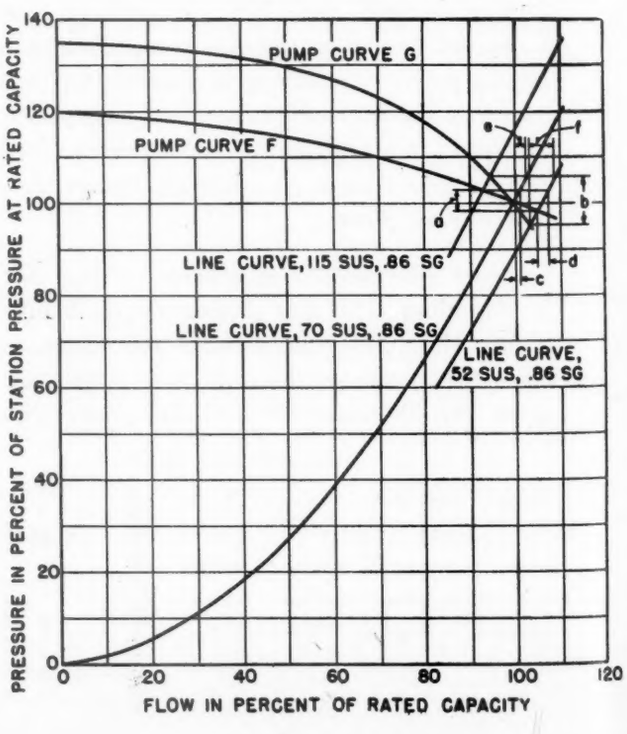


FIG. 5. Variations in station operating pressure for typical viscosity changes in crude oil carried by line.



pump onto the line smoothly. The oncoming unit can be started with the control system set to maintain the previously existing pressure at the station discharge, and then by slowly increasing the discharge pressure setting, the pressure increase can be made effective on the line very gradually with a minimum of pressure surges. In shutting down a unit, smooth line conditions are attained by first gradually reducing the station discharge pressure control setting to the value anticipated without the unit, and then stopping the unit. Automatic pressure-limit control by throttling has contributed on numerous lines, both product and crude, to smooth operation with constant speed pumps, and has prevented many interruptions that would have occurred due to development of pressures beyond the settings of protective shutdown devices.

Constant speed pump operation on liquids varying in viscosity. When the pipe line must handle liquids varying in viscosity, the pressure changes encountered with constant speed motor drive are minimized by using pumps having relatively flat head-capacity characteristic in the normal operating range. Fig. 5 shows a typical pump characteristic (F) in combination with the pressure-flow characteristic for average operation with oil of viscosity 70 Saybolt Universal Seconds at 70 F, also for viscosity 52 SUS representing summer conditions and for viscosity 115 SUS representing winter conditions. With the comparatively flat pump curve shown, the pressure variation (a) is only from about 3 per cent above to 2 per cent below the pressure corresponding to 100 per cent throughput at average viscosity, a range of approximately 5 per cent. A steeper pump curve such as G would have resulted in increased pressure range (b) approximately 11 per cent between the same limits of viscosity.

For simplification in Fig. 5 pump curves E and F are shown as unaffected by the change in viscosity. Actually the pumps will deliver somewhat lower pressure as the viscosity increases, reduction in pump pressure being possibly 1 per cent for the viscosity range applying in this particular case. This narrows correspondingly the range of operating pressures.

Depending upon individual case investigation, it may prove advantageous to install an adjustable-speed supplementary pump to handle full station throughput and deliver an adjustable incremental pressure to maintain the total pressure at the value determined by maximum viscosity, thereby realizing at lower viscosities greater flow than would be otherwise obtained. However, the benefit from this procedure depends upon the slope of the pump characteristic and the viscosity range. In the case of this line, examination of typical pump characteristic F in conjunction with the line curves indicates that this procedure would increase the flow by only about 1 per cent (c) for the average viscosity of 70 SUS and by about 2 per cent (d) for the minimum viscosity of 52 SUS. These increases are approximately 2 and 5 per cent, respectively (e and f) for pump characteristic G, which has an unusually high slope in the normal operating range.

The conditions here represented are those of a low viscosity crude, operating in the turbulent flow range. For highly viscous crudes these differences become many times greater and the pipe line flow may change from turbulent to laminar, requiring quite different treatment. Actually the pipe line represented by Fig. 5 is being equipped with constant speed pumps of relatively flat characteristic, three full-head and one half-head unit per station, each station including an automatically controlled throttling valve to limit the station pressures.

(Second and last installment will be carried in an early issue.)

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Supertanker Launched

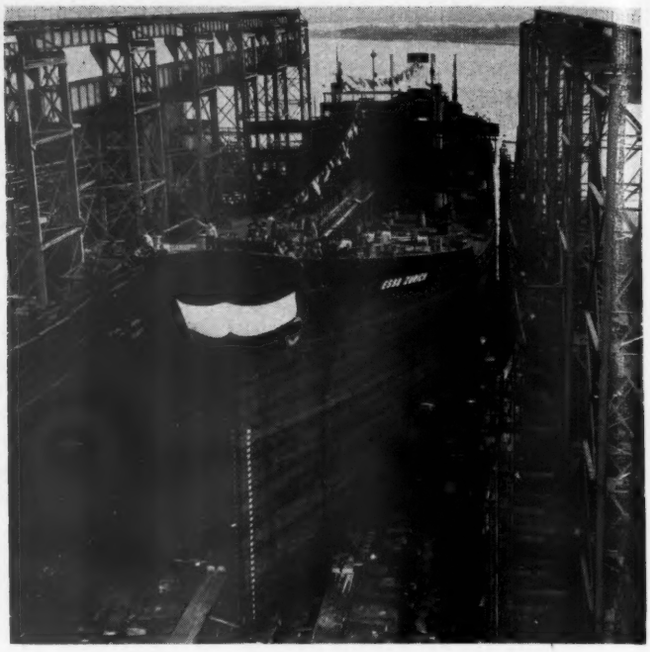
The *SS Esso Zurich*, first of 58 supertankers now on order or under construction, was launched at the Sun Shipbuilding and Drydock Company yards in Chester, Pennsylvania. The tanker was built for the Standard Oil Company (New Jersey).

The *Esso Zurich* has 30 cargo oil tanks, three abreast, running from the forecastle to the engine compartments below the stern house. A sharply raked prow and cruiser stern gives the new ship a modern appearance. Dimensions are: 628 ft long 82 ft 6 in. beam, and 42 ft 6 in. deep.

General Electric geared turbines supply 12,500 hp at 112 propeller rpm to give the vessel a designed speed of 16 knots. Steam conditions are 835 psig at 840 F at the turbine inlet. Having a deadweight capacity of 26,555 tons, the tanker is capable of carrying 228,000 bbl of cargo oil.

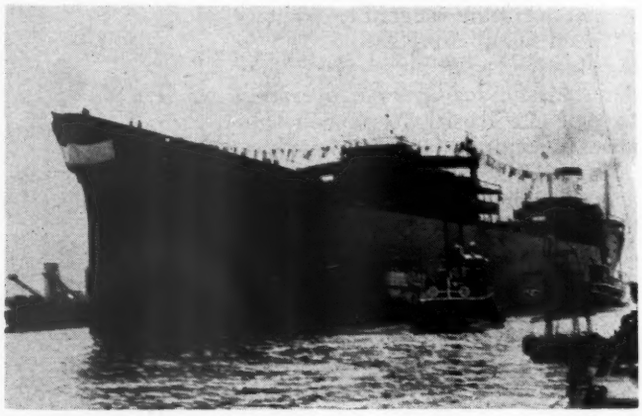
Practically all electrical equipment on board, including the two 400-kw turbine-generator sets that supply electrical power, have been built by G. E.

The *Esso Zurich* is part of the tanker-building program that has been underway in this country for nearly a year. The majority of the tankers being built or under contract in this program are of the *Esso Zurich's* class. * * *

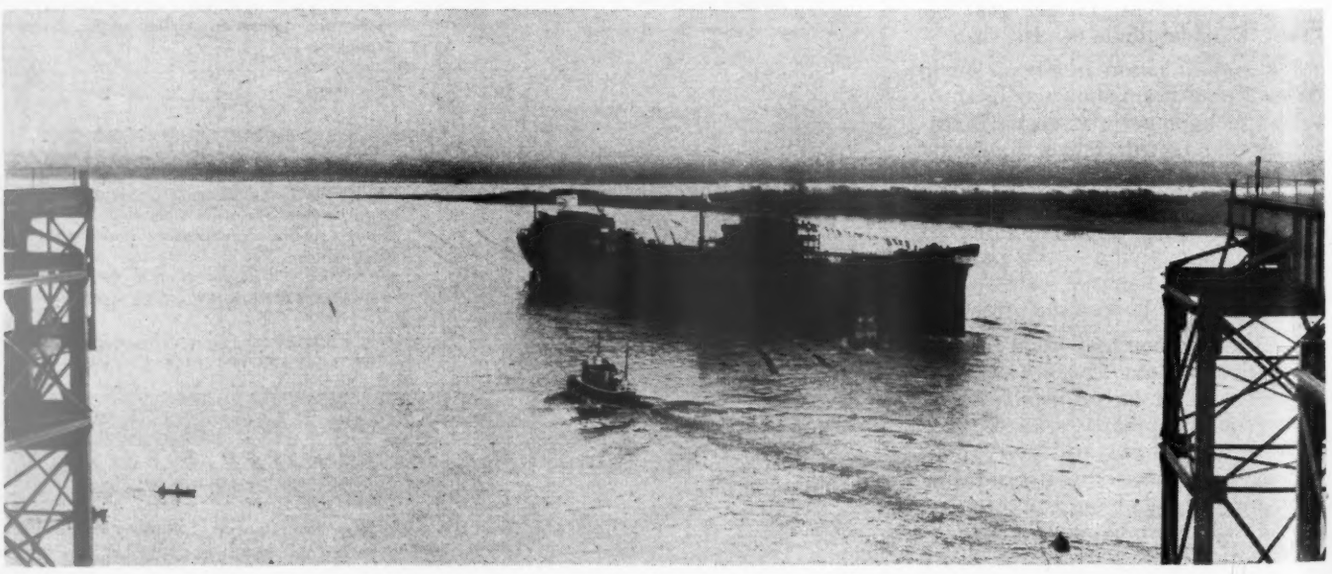


The *Esso Zurich* slides down the ways and becomes the first supertanker to take to the water in the gigantic tanker-building program now underway.

Esso Zurich as she cleared the ways and floated free.



The *Esso Zurich* being moved by tugs immediately after her launching.



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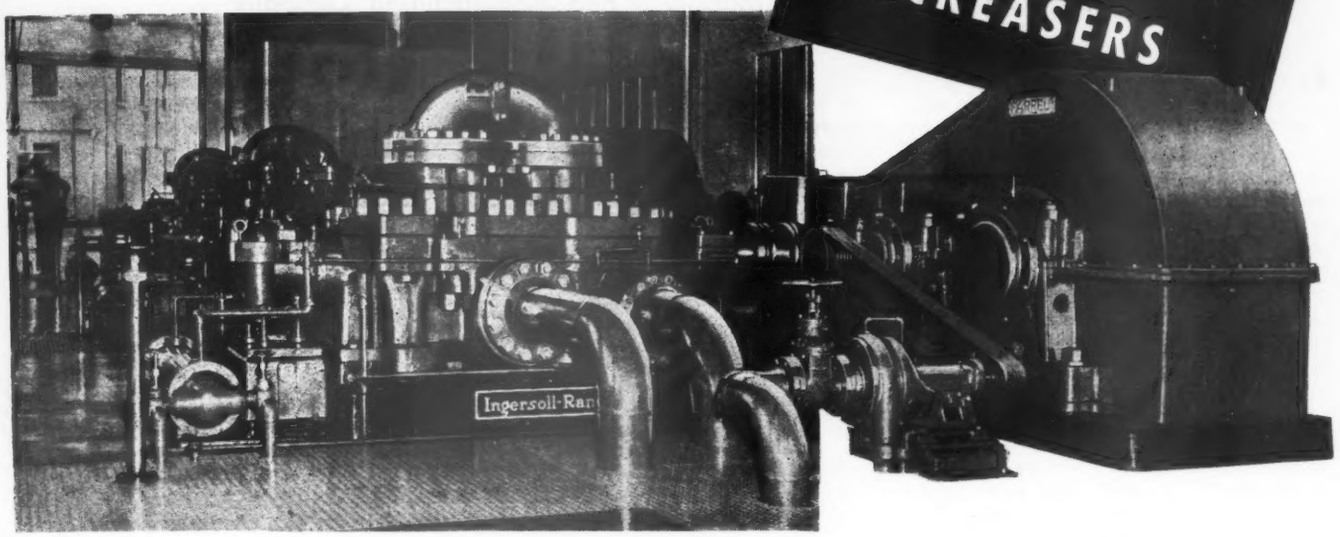

Farrel speed increasing units of the double step-up type are made with ratios ranging from 12:1 to 40:1. Single step-up units are available in 49 standard sizes with speed ratios from 1:1 to 12:1.

Three of these double step-up units, at Ohio Oil Station, Martinsville, Illinois, are each transmitting 1300 HP from 240 RPM Diesel engines to centrifugal pumps operating at 3150 RPM.

Gears and pinions are *precision-generated* by the famous Farrel-Sykes process. The first step-up is handled by continuous tooth herringbone gears—the well-known *Gear with a Backbone.* For the second step-up, twin sets of single helical gears with opposed helices are used.

Other features, which assure continuous, efficient service throughout a long life, include: Oversized shafts, ground to close tolerances... precision bearings... a self-contained circulating oil system... and a heavy, cast, double-walled base.

Full information about the complete line of Farrel single and double step-up units will be sent to you promptly, on request.

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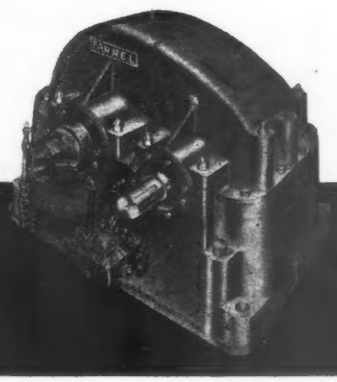


FB-524

Farrel-Birmingham

Pipe Line Casing Seals Fabricated*

By DON L. HILL, T & H Machinery and Manufacturing Company

In the design and construction of modern pipe lines for transporting crude oil, petroleum products, or natural gas, much emphasis is placed on materials, equipment, and construction methods that insure maximum operating efficiency and minimum maintenance costs. Consequently much progress has been made in reducing maintenance and operating costs by extensive use of pipe line protective coatings and cathodic equipment that protect the lines against soil corrosion.

At locations where pipe lines cross highways and railroads it is customary practice to encase the pipe line with a larger size of pipe in order to meet the requirements of safety that have been standardized throughout the country. The space between the pipe line and the casing placed under the highway or railroad is closed with two special rings generally known as casing seals. These seals are designed to seal the casing ends against water seepage that may carry corrosive elements and to provide an efficient insulation between the pipe line and the casing to prevent the escape of the electric current that is supplied by the cathodic units to retard corrosion.

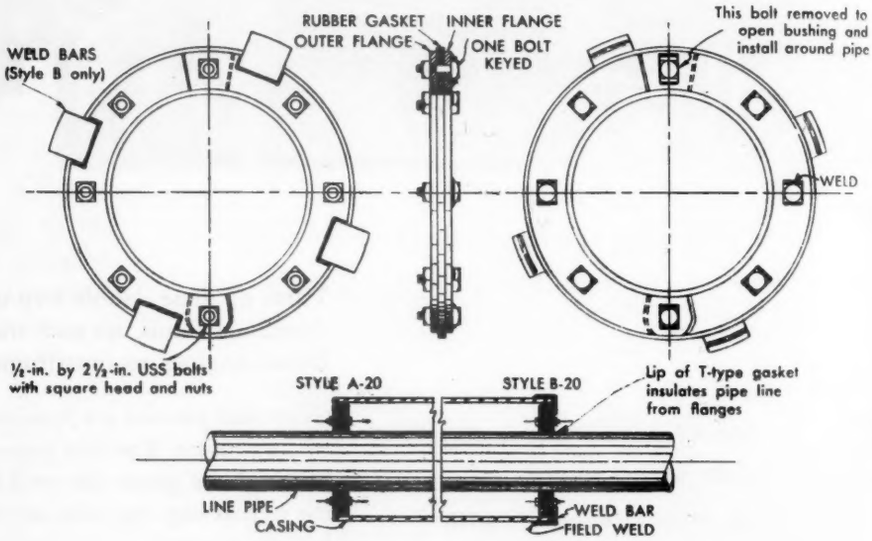
Several hundred casing seals may be required on long pipe lines such as are under construction at the present time. Casing seals are made to meet all sizes of pipe and casing requirements.

Each casing seal is composed of two rings or flanges, which are flame cut from ⅜-in. thick steel plate and have an outside diameter slightly smaller than the inside diameter of the casing and an inside diameter slightly larger than the outside diameter of the pipe line to provide the space required for a "T" shaped rubber gasket. The tongue of this gasket is placed between the two flanges and held in position with standard machine bolts spaced about 4 in. apart on the intermediate diameter between the inside and outside of these flanges. The webs of the gasket extend beyond the inner surfaces of the flanges and rest against the pipe line when installation is made, thus creating an insulating seal between pipe and casing. All bolts are arc welded to the inner flange except the master bolt, which is removable for installation of the casing seal around the pipe line. Each flange is cut into halves in such a manner as to allow opening and closing by the removal of the master bolt. The casing seal is held in position on the end of the casing by four straps, which are arc welded to the outer flange at 90-deg intervals. The other end of these straps are arc welded to the outside of the casing at the time of installation. The bolts are tightened to expand the rubber gasket, which forms the seal.

Until recently the method of cutting these flanges was to begin with the largest size currently used and cut all smaller sizes from the circular plate remaining. This method proved to be economical only when it was possible to utilize all material in building the smaller sizes in quantities equal to the demand for the larger sizes.

*Data and illustrations are from a study submitted to The James F. Lincoln Arc Welding Foundation, Cleveland, Ohio, in its $200,000 Design-for-Progress Award Program for reports on advancements and improvements made by the applications of arc welding in design, fabrication, construction, and maintenance.

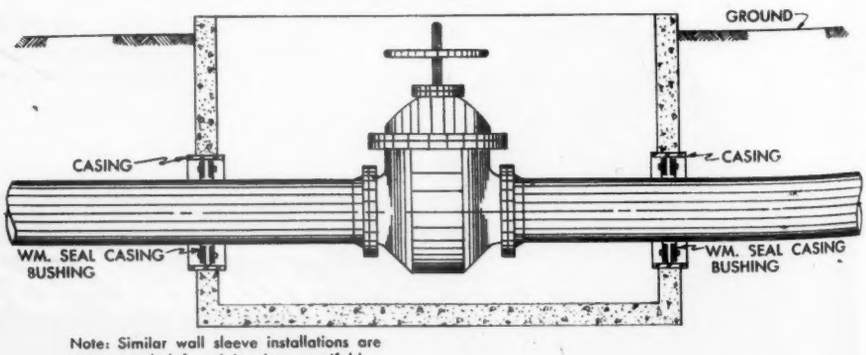
Pipe line casing bushing.



Nominal Size Pipe	Casing	No. of Bolts ½" x 2½"	Approx. Wt. (Lb.)	Nominal Size Pipe	Casing	No. of Bolts ½" x 2½"	Approx. Wt. (Lb.)
4"	8	6	10½	16"	20	12	26
6"	10	6	13	18"	22	14	28
8"	12	8	16	20"	24	16	32
10"	14	10	16½	22"	26	18	36
12"	16	10	17	24"	28	20	39
14"	18	12	23½	26"	30	22	42

Other sizes built to order.

Casing bushings on pipe line gate box.



Note: Similar wall sleeve installations are recommended for piping into manifold pump and compressor rooms

The current trend in pipe line construction is definitely toward the use of large diameter pipe. Consequently, the manufacturer of casing seals was faced with the problem of economical disposition of the steel that could have been used in building smaller sizes of seal rings. Over a period of time this unused material represented a substantial investment. In recent months it became apparent to the management that production methods would have to be changed to permit production of the large sizes of casing seals economically and without further increase in stocks of steel plate that could only be utilized in production of small casing seals.

This problem was overcome by fabricating special jigs by arc welding that permit assembly of flames for the large casing seals from four steel segments that are flame cut on the proper curvature to form a perfect circle. After each segment is cut to the proper length four

☆ ☆ ☆

Texas exports natural gas by gas lines to 23 states and to Mexico. Largest amounts go to Colorado, Illinois, Indiana, Kansas, Michigan and Ohio. —*The Petroleum Data Book*, Dallas, Texas.

☆ ☆ ☆

segments are placed in the jig and the seams between the segments are arc welded into one continuous circle. The excess weld metal is removed by grinding, leaving a smooth flat ring. From this point on the methods employed to produce the finished product are the same as before mentioned.

Under the new production method the total weight of scrap represents less than 20 per cent of the original weight of the steel plate required in producing the flanges. This results in a large saving of steel plate, which is still very scarce. It also eliminates further increase of steel inventories that move very slowly.

As previously stated, the current practices of production are new and it would be difficult at this time to make a direct comparison of saving in production costs; however, the following figures are given as a matter of comparing the quantity of materials used in previous and current methods:

Quantities of steel required to fabricate 100 size 20-in. by 24-in. casing seals. Previous method, 12,240 lb; present method, 2830 lb.

It is evident from these figures that the saving in material costs would be approximately 75 per cent; however, the labor costs have increased approximately 30 per cent.

By these improved methods, which have been made possible by arc welding, this company hopes to continue production of casing seals without further increasing the cost of the finished product.

The author is co-owner and manager of the plant that manufactures these casing seals for a national distributor. This product was developed jointly by the manufacturer and distributor. The distributor has applied for a patent covering the patentable features of the casing seal.

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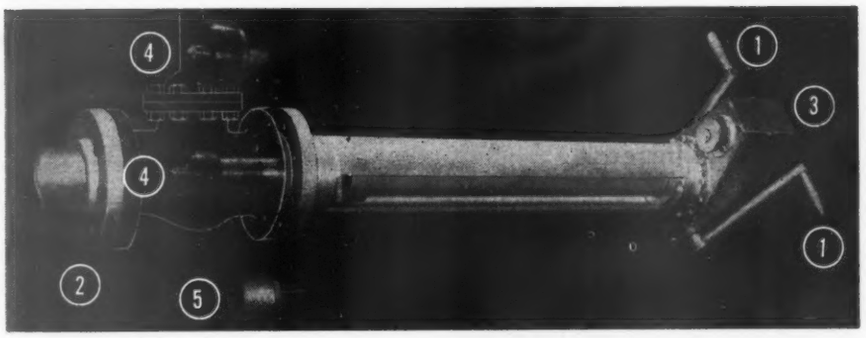

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FEATURES—

2,000 p.s.i. test pressure.
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Flanged (or threaded) Tapping Nipple (2) welded to pipe line.

Automatic feed (3) protects shell cutters (4). Pilot Drill (4) holds "coupon" in shell cutter. Nipple Plug (5) permits removal of tapping valves ... an exclusive feature.

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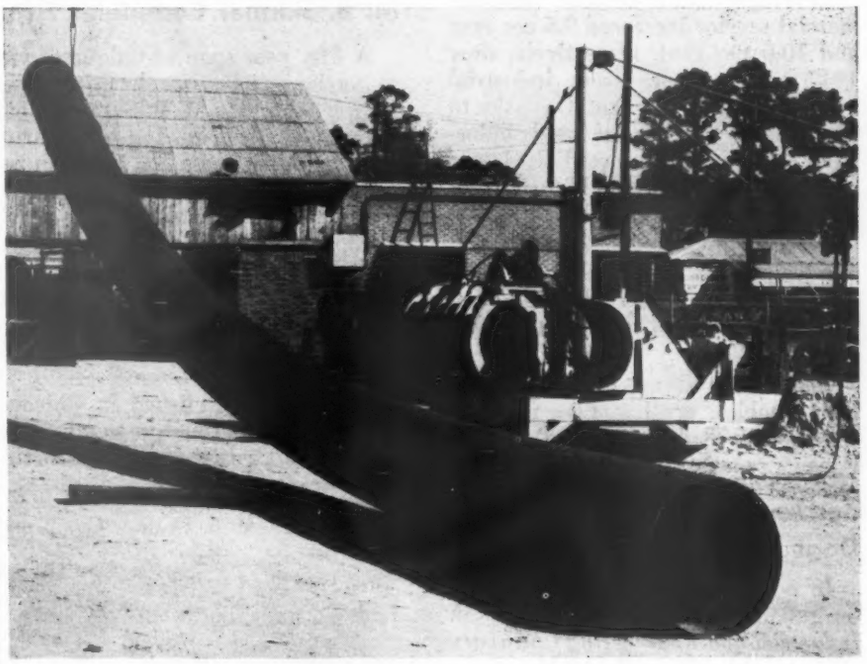
*Patent No. 2,097,398
Other Patents Pending



THE BEND AND THE MACHINE THAT DID IT

Two joints of 30" pipe, with .314 wall welded together and bent to 25° with tangent at both ends. Pipeline contractors who saw this demonstration realized at a glance the many ways this equipment could save them money in labor and production. Portable equipment, such as Cleaning and Priming, Doping and Wrapping Machines can travel over these bends in a continuous operation without "holidays".

THE COODY BENDER CO.

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NEWS

Natural Gas Revenues And Income Increase

Operating revenues of natural gas companies reporting to the Federal Power Commission totaled $852,130,000 in 1948, a 14.9 per cent increase over the $741,539,000 received in 1947, according to figures released by FPC.

Gas operating revenue deductions increased 16 per cent to $702,476,000. Of this amount, operating expenses accounted for $527,310,000, depreciation for $73,261,000, and tax accruals for $101,905,000. Percentage increases over 1947 were 16.8 per cent, 14.3 per cent, and 13.2 per cent in operating expenses, depreciation, and tax accruals, respectively.

Natural gas utility operating income in 1948 was $149,791,000, an increase of 10.1 per cent over the $136,093,000 reported in 1947.

Gross income, including gas utility, other utility, and non-operating income amounted to $199,559,000, an increase of 10.4 per cent over the previous year. Net income for the period was $159,591,000, up 7.6 per cent from the 1947 net of $148,378,000.

Revenues from residential and commercial service increased 9.5 per cent and 10.6 per cent, respectively, over 1947 and revenues from industrial service rose 15.3 per cent. Gas sales to residential, commercial, and industrial consumers increased 10.1 per cent, 11.0 per cent, and 11.9 per cent respectively.

Book cost of gas plant of the reporting companies aggregated $2,735,632,000 on December 31, 1948 compared to $2,470,882,000 on the same date in 1947.

These figures, taken from the attached tables, are based on monthly statements filed with the Federal Power Commission by 82 natural gas companies.

Dogs Detect Gas Main Leaks

In contrast with technical articles on gas leak detection was a story in *Industrial and Engineering Chemistry* about two bloodhounds that have been trained to spot mercaptan ordorant. The dogs, named Joe Captan and Ethyl Captan, were trained by J. C. McClelland, who coached dogs in the K-9 corps. They can detect leaks much more rapidly than the average crew with combustion meters, and have actually located leaks too small to register on a meter.

New Sales Setup for Cathodic Protection Products

Sale of cathodic protection products for retarding electrolytic corrosion of pipe lines and industrial equipment has been transferred from the Magnesium Sales Division of The Dow Chemical Company to Dowell, Inc., a wholly-owned Dow subsidiary, according to an announcement by the parent company.

The line includes five sizes and types of cored magnesium anodes, a package unit (Galvopak) in two sizes, and Galvoline, a cored magnesium ribbon. The latter is designed for underground installation with conventional cable laying plows whereas the Galvopak units simplify effective installation of cast anodes by incorporating the anode and a specially prepared backfill material in a permeable cloth sack.

The magnesium anodes are regarded to have a large potential both in the protection of pipe lines and the protection of industrial heat exchangers and other equipment subject to electrolytic corrosion.

The Dowell organization has headquarters in Tulsa, Oklahoma, and maintains some 45 offices and field stations.

Guy Williams, assistant sales manager and a member of the Dowell staff for 12 years, heads up the new sales activity. Yale Titterington, a Dow corrosion and development engineer for seven years and previously corrosion engineer for the Northern Natural Gas Company, will handle technical service aspects.

Only one type of magnesium anode, a cored rod for use in domestic hot water heaters, is retained by the Dow Magnesium Sales Division.

Rate Hearing Postponed

The Federal Power Commission has postponed indefinitely the hearing previously scheduled to begin March 14, in Washington, D. C., concerning supplemental suspended rate schedules proposed by Texas Eastern Transmission Corporation to increase rates and charges on sales of natural gas by application of tax adjustment clauses reflecting a new Louisiana tax upon gas produced in that state.

The postponement is the third made by FPC on request of the company. Texas Eastern had agreed that if the new postponement was granted it would not move to put the schedules into effect prior to final determination in the proceeding by the commission.

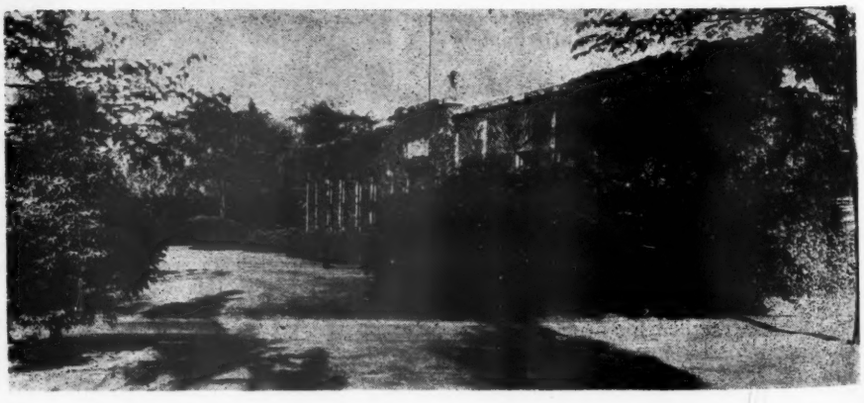
M. B. Skinner Completes Fifty Years of Service

A fifty year span of unique service to various industries has just been completed by the M. B. Skinner Company of South Bend, Indiana. During this period Skinner has filled an unusual position in American industry by supplying specialized pipe repair clamps and allied products that have assisted water, gas and petroleum companies, power plants, and others in maintaining practically an uninterrupted flow through mains and pipe lines.

Originally established in Chicago, Skinner has operated in South Bend, Indiana, since 1928, in a plant setting which is likewise unusual in American industry. Every Skinner employe takes pride in the appearance of the plant grounds, which resemble a private estate rather than a factory. Skinner, a pioneer in profit sharing, has a record of no strikes or work stoppages since the founding of the company. The average length of service with the company is 12 years.

In times of pipe shortages, such as the present, Skinner service is especially valuable, since it results in the saving of untold tons of steel otherwise necessary for the replacement of faulty pipe.

M. B. Skinner Company plant at South Bend, Indiana



Ohio Fuel Proposes 85-Mile Gas Line

The Ohio Fuel Gas Company, a subsidiary of The Columbia Gas System, Inc., has asked the Federal Power Commission to authorize the construction of 85.5 miles of natural gas transmission pipe line in central Ohio to replace approximately 84 miles of line that the company proposes to retire. Estimated cost of the construction is $4,167,000.

The company said the proposed new facilities would provide increased capacity for the transportation of gas from out-of-state sources to underground storage areas in summer for withdrawal and marketing in winter.

FPC Rules No Jurisdiction In Delhi Gas Sales Case

The Federal Power Commission has issued a declaratory order that the proposed sale of natural gas by Delhi Oil Corporation to El Paso Natural Gas Company is a transaction falling within that section of FPC's general rules covering sales by producers and gatherers over which it does not assert jurisdiction.

Delhi, in an application filed last month, asked the commission for a status determination and declaratory order that the company is not a "natural-gas company" as defined by the Natural Gas Act and that its proposed transactions with El Paso will not be subject to FPC jurisdiction.

The application stated that Delhi, which owns leases covering large gas reserves in the Barker Dome field of the San Juan Basin in New Mexico and Colorado, has entered into a 25-year contract with El Paso to supply 110,000,000 cu ft of gas a day.

Propose to Construct And Retire Gas Lines

The Federal Power Commission has been asked to authorize the construction, retirement, and sale of natural gas facilities in New York and New Jersey on the Home Gas Company and Eastern Pipe Line Company systems.

Home Gas is seeking authorization to construct approximately 70 miles of pipe line in Orange, Sullivan, and Rockland counties, New York; to retire about 44 miles of pipe that forms an 11-mile transmission system in Orange County, and to sell approximately 10 miles of pipe line in Cattaraugus County, New York, to the Keystone Gas Company, Inc.

Eastern Pipe Line Company proposes to retire a pipe line system that extends 50 miles southeast through New Jersey from a point on the New York-New Jersey line in Sussex County to another point on the state line in Bergen County. Both companies have main offices in Pittsburgh, Pennsylvania.

Colorado-Wyoming Gas Company Given Authorization

Colorado-Wyoming Gas Company, of Denver, Colorado, has received Federal Power Commission authorization to construct approximately 41 miles of additional natural gas pipe line on its system and to install appurtenant meter stations and compressor units. The company also received FPC authorization to abandon approximately 17 miles of line and two compressor stations.

Canadian Line Planned

A products pipe line from Montreal to Toronto, Canada, is being planned jointly by three major oil companies —British-American Oil Company, McColl Frontenac Oil, and Shell Oil Company. A petition has been filed in Ottawa to obtain a special act of incorporation. The line would be 330 miles long and would transport petroleum products from refineries at Montreal to Toronto and intermediate points in Ontario.

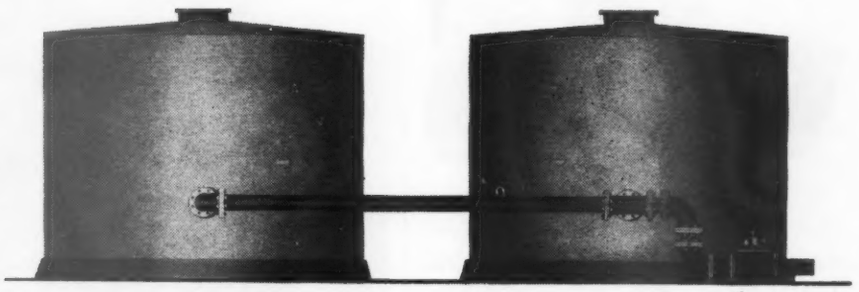
GATHERING SYSTEM

Strangler

The ENARDO

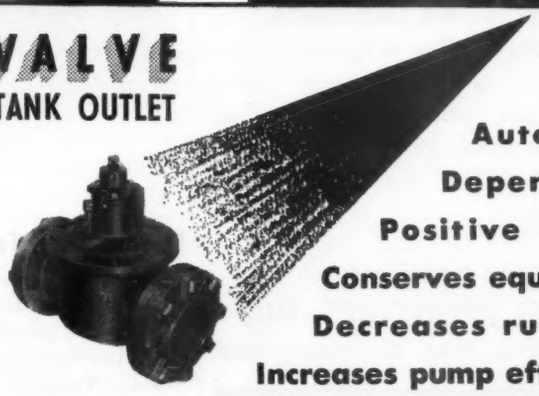
PIPELINE SHUT-OFF VALVE

SHUTS OFF THE FLOW BEFORE AIR CAN ENTER TANK OUTLET



Through the controlled closing movement of this balanced diaphragm motor type valve, line shocks and hammer are greatly decreased and close tank limits are assured. The hydrostatic head of liquid above the valve causes it to open with the pipe line stops and to close just before air can enter the tank. There need be no aerated oil in the gathering system if you install the Enardo 1950 Pipe Line Shut-Off Valve.

Available in 2", 3", 4" Pipe Size.



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Decreases run time
Increases pump efficiency

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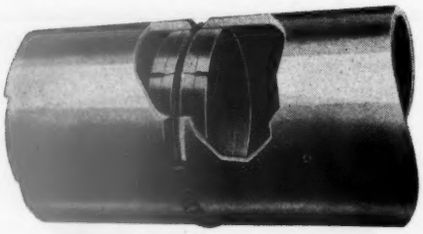
It is imperative that pipe and refinery line joints are made as strong as possible to prevent costly failure. WEDGE Chill Rings with the patented SPLIT Feature REINFORCES the joints making them the strongest part of the line. In



case of shock, strain, or vibration the pipe will fail before the reinforced joints. Because WEDGE Chill Rings REINFORCE the joints it is possible to SAFELY use thin wall pipe and thereby make substantial savings. Why not find out what WEDGE Chill Rings will do for you? They are saving money for many.

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"Big Angle" Compressors Ordered for "Biggest Inch"

Batteries of Clark "Big Angle" gas engine driven compressors totaling 88,000 bhp will be installed in pumping and booster stations along Transcontinental's 1839 mile "biggest inch" pipe line from Texas to New York, it is revealed by C. P. Clark, president of Clark Brothers Company, Inc. of Olean, New York, and a director of the parent organization, Dresser Industries, Inc.

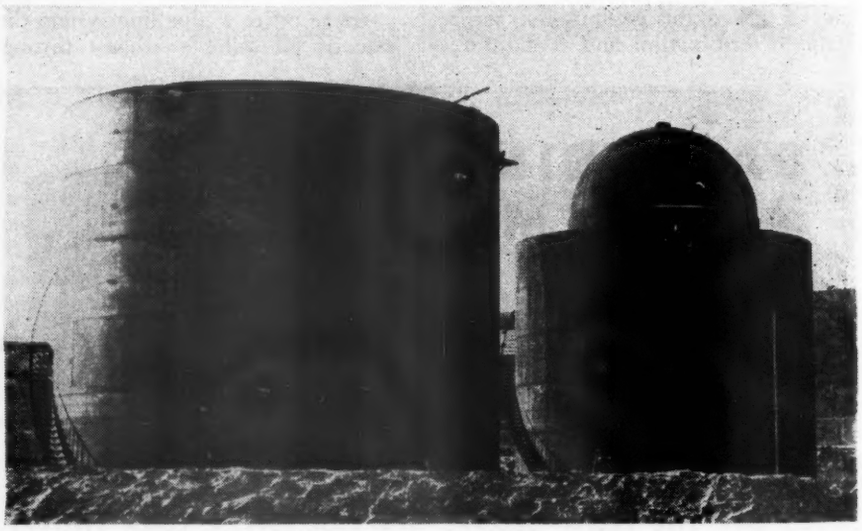
Clark said that the $6,000,000 order received through the Fish Engineering Corporation, Houston, Texas, contractors for Transcontinental Gas Pipeline Corporation, called for delivery of 55 of the huge Clark 1600 bhp angle units. Part of the order, one of the largest to be placed by the industry for gas engine driven compressors, is subject to the approval of the Federal Power Commission, it is understood. The BA units, Clark said, were developed from initial designs created in part as far back as 1919 when Clark Brothers built its first direct connected 2-cycle gas engine driven compressor.

Realizing that a marked expansion in gas transportation was inevitable following the war, Clark Brothers had already undertaken considerable research and development, according to C. P. Clark, and was completely tooled up and ready to build these angle units when the actual trend got underway.

Since the introduction of this type of unit to the industry in 1937, Clark Brothers have built and installed more than 2,225,000 hp in these gas engine driven compressors, Clark estimates.

The Transcontinental pipe line will originate in the Roger Lacy field, Hidalgo County, Texas, approximately 15 miles north of the Rio Grande River, follow the coastal plains along the Gulf of Mexico, through Georgia, and then northeasterly to the Atlantic coast and a terminus on the East bank of the Hudson River at 132nd Street, New York City.

The 1210 mile stretch from Opelousas, Louisiana, to Chester Junction, Pennsylvania, will be made up of 30-in. diam pipe from which the line gets its nickname, "Biggest Inch" in the industry.



Socony-Vacuum storage tanks in Massachusetts.

Dome-Type Tank

A new dome-type storage tank (right in picture), designed to prevent loss of gasoline through evaporation, has been put into operation by Socony-Vacuum Oil Company, Inc., at its plant in Worcester, Massachusetts.

The dome section of the tank contains a flexible diaphragm made of nylon coated with Perbunan rubber and is like the half of a giant rubber ball.

When vapors expand in the tank, the diaphragm expands inside the steel dome and holds the vapors within the tank. When temperatures drop, the diaphragm contracts but air is not drawn into the section where the gasoline is stored. Air is always present between the outer surface of the rubber ball and the metal shell that houses it. The amount of this air comes and goes as the rubber section expands or contracts.

The odd-shaped tank is the first of its kind to be put into operation by Socony-Vacuum and is also the first to be built in the country. It was built by Chicago Bridge and Iron Company.

William P. Alexander began work for Standard of California in 1912 and was an oiler at one of the Southern Division stations when he answered the call to service in the first world war. He suffered an impairment of his vision while in France, and was unable to resume mechanical work when he returned. He took a course in telephone switchboard work, however, and in 1922 was given a "communications" job at the Northam station, where he has remained until the present time. "Alex," as he is widely and popularly known, became eligible for the 30-year watch award, as all Standard Oilers do at the end of 30 years service, but because of his defective vision, a search was instituted for the right kind of a watch. It was finally located in Switzerland and at a recent gathering of pipe liners was turned over to Alex. It has a heavy gold hunting case, with his initials engraved on the front and the 30-year inscription on the inside of the back. It is equipped with a raised Braille-type dial and for good measure is "wired for sound." When Alex presses a plunger on the side of his chronometer it chimes the hours deliberately, the quarters a little faster, and then in rapid succession rings off the minutes. Next time you see him he is going to be annoyed if you don't ask him what time it is.

FPC Authorized 8500 Miles Gas Lines in 1948

Sharply mounting demands for natural gas service and electric power, which began in 1946, continued on to new high levels in 1948 making the year one of the "most active" in the Federal Power Commission's 28-year history, FPC has reported.

The report says that whereas the number of certificates issued during the year authorizing construction of interstate natural gas transmission facilities dropped to 98 as compared with 132 in fiscal 1947, the projects authorized in 1948 were on the whole "more extensive and costly than ever before." The year's authorized facilities involve construction of nearly 8500 miles of new pipe line, the addition of more than half a million horsepower at compressor stations, and the potential expenditure of more than half a billion dollars, the report adds.

ABS Cites Progress on Fitting Crack Arrestors

According to the report of the American Bureau of Shipping issued this week, the fitting of riveted crack arrestors on T2-SE-A1 tankers, was practically completed during the first half of 1948. This requirement for maintenance in ABS class was adopted in the latter part of 1947 following conclusions reached by the Technical Sub-Committee of the Tanker Committee of the Institute. At present, of the 413 vessels of this type classed with ABS, all but two have had the crack arrestors fitted. These two vessels have been unavailable for this work, but it is scheduled to be done within the near future. There have been reported three cases of fractures that might have been serious had not crack arrestors been fitted. In no case has a crack passed the arrestor, states the ABS report.

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OILCO

Pipe Line
Marine Transportation
Personals

John Lamb

JOHN LAMB, who heads the Marine Research and Development Department of The Anglo-Saxon Petroleum Company, Ltd., a department he organized in the Fall of last year, was born at Forest Hall, Northumberland, England, August, 1890. His engineering apprenticeship was served with Clarke Chapman and Company, Ltd., Gateshead-on-Tyne, from 1905 to 1910, and he made his first voyage in motorships in 1914 as second engineer. He was appointed superintendent engineer by Anglo-Saxon in 1924, and was made a director of F. J. Trewent and Proctor, Ltd., in 1938, remaining with this firm of consulting engineers and naval architects for two years. He returned to Anglo-Saxon in 1940 as chief marine superintendent.

During his career he has published three books: "The Running and Maintenance of Marine Diesel Engines" (1919), "Question and Answers Relating to Diesel and Other Internal Combustion Engines" (1920), and "Motorship Auxiliary Equipment" (1934), the last in two volumes. He has presented numerous papers before technical societies and was awarded the Denny Gold Medal for the best paper in 1947 by the Institute of Marine Engineers.

Lamb is quiet and unassuming but speaks with authority on a diversity of subjects and is a keen searcher after knowledge, particularly in connection with transport, whether it be on land, sea, or in the air.

When asked about his hobbies he will tell you that he has none in particular, but in course of conversation you will find that there is very little that does not have some special interest for him. He plays no games, taking only a newspaper interest in all forms of sports, but he thoroughly enjoys a good country walk with his dog, his favorite breed being the bulldog.

You will hear from Lamb that he knows nothing whatever about gardening, but in course of time you will learn that this is not strictly true, as it is almost impossible for him to have no knowledge about something he appreciates. And he has a passion for flowers, one of the duties of his secretary being to see that there are always flowers on his city office desk.

Perhaps Lamb's main relaxation is reading, particularly old books, of which he has a fine collection, describing the trials, tribulations, and triumphs of pioneers in the shipbuilding, engineering, and all other heavy industries. Another form of relaxation is motoring. He likes a really good car, and being country born and bred appreciates the facilities it affords for easy access to the beauties of the countryside and the study of bird and insect life.

He has two granddaughters, now aged 7 and 2 years, and since they "found their feet" he has discovered a new interest in photography, not in the technical so much as in the artistic approach.

Having had to spend a fair amount of time during latter years in hospitals Lamb appreciates the value of good nursing, and takes a very keen practical interest in that noble profession, and it is not unlikely that in the furtherance of "The John Lamb Fund" he will find his most absorbing hobby. He started this fund in 1947 and the accruing interest is used to provide prizes bi-annually for the most meritorious nurses. So far it is confined to one hospital, but Lamb is hoping that eventually he will be able to extend it to other hospitals as a token of thanks and encouragement for the kindness he has received at the hands of the nursing profession, and to keep alive the voluntary spirit so essential where sickness is concerned.

▸ **Charles A. Gilkison** has been promoted by Northern Natural Gas Company to district foreman at Superior, Iowa. Gilkison, who has been a utility man at Paullina, Iowa, for about five years, succeeds **Mathew Craddock,** who died recently.

Russell P. Knudsen has been made foreman of the Bushton, Kansas, pipe line district. He replaces **L. F. Kirchoff,** who was promoted to division superintendent at Bushton following the death of **A. H. During.** Knudsen has been maintenance man at Ogden, Iowa.

Freeman U. Guillaume has been fulfilling the duties of crew foreman at the South Sioux City pipe line district since the first of the year, at which time this position was created.

▸ The Pipe Liners Club of Tulsa has announced the following new members: **Arthur J. Elbert, Jr.,** field engineer, National Tube Company, Tulsa; **Creed F. Gearhart,** hydraulic engineer, Stanolind Pipe Line Company, Tulsa; **Theo. Gupton,** district manager, Diesel Engine Division, American Locomotive Company, Tulsa; **William E. Huddleston,** Huddleston Engineering Company, Bartlesville, Oklahoma; **Robert R. Hughes,** manager, Industrial X-Ray Engineers, Tulsa; **R. P. Lennart,** senior engineer, Stanolind Pipe Line Company, Tulsa; **Frank H. Love,** editor, Pipe Line Edition, *The Petroleum Engineer,* Dallas, Texas; **Duane D. Lunger,** engineer, Interstate Oil Pipe Line Company, Tulsa, and **Jim Ritchie,** owner, Jim Ritchie Company, Tulsa.

Andre S. Rubin, Jr.

▸ **Andre S. Rubin, Jr.,** has been named sales manager of Marlow Pumps, Ridgewood, New Jersey. Rubin became affiliated with Marlow Pumps in 1942 when he was made assistant to the late A. S. Marlow, Sr., founder of the organization. He has been active since that time in the development of its line of self-priming centrifugal pumps for the oil country, and has worked extensively with S. L. Stentz, of Tulsa, in bringing the advantages of the Marlow diffuser priming method to the attention of pump users in the oil industry.

▸ **W. R. Lattimore,** chief engineer of the Afton station of the Ajax Pipe Line Corporation, recently completed 30 years' service with the company, in honor of which he was given a banquet by the company and presented with a 30-year service emblem.

▸ **T. F. Welsh,** district superintendent for the Interstate Oil Pipe Line Company, died recently as a result of injuries received in an automobile accident near Magnolia, Arkansas. A native of Wallaceburg, Ontario, Canada, Welsh began work with the company in 1916. Funeral services were held in Shreveport, Louisiana.

▸ **N. H. Perry,** Houston, Texas, vice president in charge of pipe line operations for Gulf Oil Corporation and Gulf Refining Company has retired. Perry was elected a vice president of the company three years ago, succeeding E. C. Kincade, deceased. Prior to that time he had served for 27 years as general superintendent of pipe lines.

Perry's successor is **J. L. Irvin,** whose title will be that of general manager of pipe lines, Houston division. Irvin has been with Gulf since January, 1917, and has served as general superintendent of pipe lines since 1946.

Perry began working for the company in the old Batson field. He was a fireman at a steam pump station in that area, later an engineer at Lufkin, then chief engineer at Lufkin. He served as a pipe line superintendent for the company in Tampico, Mexico, for five years. He has lived in Houston since 1919.

Irvin was born in Victoria, Texas, served his apprenticeship as a machinist in Victoria, and was employed by Gulf at Beaumont. He served in France during World War I, and upon his return to Gulf after the war progressed from machine shop foreman to machine shop superintendent to assistant chief engineer in 1929. Since 1929 he has been assistant general superintendent, general superintendent, and now becomes general manager.

▸ **M. H. Blank** has been appointed Farrel-Birmingham Company, Inc., representative in the Detroit area to handle the sale of gears and gear units manufactured at the company's Buffalo, New York plant.

▸ **D. T. O'Connor,** 500 Fifth Avenue, New York 18, has been appointed exclusive export sales' representative of the M. J. Crose Manufacturing Company, Inc., of Tulsa, manufacturers of a complete line of equipment for laying, cleaning, and wrapping pipe lines and distributors of Vitron glass wrapping and Littleford Kettles.

▸ **Benno C. Schmidt,** a general partner of J. H. Whitney and Company, New York, and **O. Kelley Anderson,** president of Consolidated Investment Trust and of Boston Fund, Inc., have been elected directors of Transcontinental Gas Pipe Line Company. Schmidt also is a director of Hodges Research and Development Company, Standard Perlite Corporation, and Texla Gas Corporation. During the war he was on active duty with the United States Army in the European Theater of Operations as deputy general purchasing agent for the European area and was discharged with the rank of colonel. He subsequently served as general counsel to the Foreign Liquidation Commissioner of the State Department.

Anderson is a director and member of the finance committee of New England Mutual Life Insurance Company, and a director of United Merchants and Manufacturers, Inc., United Corporation, Dewey and Almy Chemical Company, Saco Lowell Shops, and other corporations, and is a trustee of Wellesley College.

▸ **F. W. Littell,** superintendent of communications and transportation, Shell Pipe Line Corporation, Houston, Texas, addressed the March 21 meeting of The Pipe Liners Club of Tulsa on the subject "Pipe Line Communications."

James W. Lawler, superintendent of the Rock River pipe line district of the Ohio Oil Company, and **Lewis G. "Jack" Harness,** pipe line superintendent of the Laramie, Wyoming, district, recently received 30-year service awards.

▸ **H. O. Porter** has been made assistant superintendent of gas transmission by Cities Service Gas Company and now has his headquarters in Wichita, Kansas. For several years he has been district superintendent of the Pampa, Straight (Guymon), and North Hugoton (Ulysses) compressor stations. **Hale Barfoot,** who has been superintendent of gas measurement in Wichita, has been appointed to succeed him. **Richard Jackson** has been named superintendent of gas measurement, promoted from his former post of meter inspector. **Robert Fleske,** also a former meter inspector, has been made Jackson's assistant.

J. H. Jenkins, formerly assistant to the superintendent of the telephone and telegraph department at Wichita, has been assigned as assistant superintendent of the Wichita compressor station.

▸ **Vincent Vandervoort** has been elected vice president of Marlow Pumps, Ridgewood, New Jersey.

▸ **W. G. Noble,** who started with Magnolia more than 33 years ago, has been made a director of the Magnolia

W. G. Noble

Pipe Line Company. Except for an interruption of two years, during which time he was a member of the armed forces in World War I, his entire business career has been with Magnolia. He advanced from clerical duties through the accounting and general administrative departments of the company to become manager of crude oil purchases and sales of the Magnolia Petroleum Company.

▸ **Richard (Dick) Jenkins** has been assigned to the Los Angeles office technical service department of Clark Brothers Company, Inc. He joined the company in 1948 following an impressive scholastic and althletic record at Yale, an educational period split by service with the 7th Army in the ETO.

▸ **Edward B. Hill,** formerly general sales manager, has been appointed vice president in charge of sales of Gar Wood Industries, Inc. Hill is one of the oldest employes of the company, having started with the old Wood Hydraulic Hoist and Body Company, predecessors to Gar Wood Industries, Inc., in 1926 as a mechanic helper, and has since worked his way up through the branch and field organization.

▸ **E. Maurice Myers,** gas engineer, has been advanced to the position of chief engineer of the Consolidated Gas Utilities Corporation, Oklahoma City, Oklahoma, succeeding **C. S. Worley,** retired. He will also have charge of compressor station operations and construction. Myers has been with Consolidated 3½ years, previously having been with the Oklahoma State Corporation Commission as oil and gas engineer.

Harris Glenn, formerly chief draftsman, has been made purchasing agent of the company, a position also held by Worley before his retirement. **James J. Noury** is Glenn's assistant.

With the PIPE LINE CONTRACTORS

O. C. Whitaker Company, Fort Worth, Texas, has completed its job for Interstate Oil Pipe Line Company, which consisted of 17 miles of 12-in. and 5 miles of 8-in. in southern Oklahoma.

H. C. Price Company, Bartlesville, Oklahoma, will lay 200 miles of the 262-mile, 26-in. gas line of Atlantic Seaboard Corporation and Virginia Gas Transmission Corporation, which will extend from Clendenin, West Virginia, to Rockville, Maryland. Price has three sections of the line starting near Cleveland, West Virginia. The company also will construct two major river crossings each consisting of four 16-in. lines. These will be across the Shenandoah and Potomac rivers. Preliminary work is being done now and actual construction will begin the latter part of April.

This contractor also will lay two sections of The Texas-Empire Pipe Line Company's 18-in. crude oil line between Patoka and Wilmington, Illinois. Total mileage will be 123.9. Work is beginning.

Bechtel-Price-Conyes, San Francisco, California, has taken a contract to construct a pipe line from Toprock, Arizona, to Milpitas, California, for the Pacific Gas and Electric Company. Total mileage will be 506 and the diameter of the pipe 30 in. and/or 34 in. The start of construction is awaiting directions from Pacific Gas, the contracting firm states.

Dunn Brothers, Dallas, Texas, is stringing 60 miles of 18-in. for H. C. Price Company on The Texas-Empire Pipe Line Company line between Patoka and Wilmington, Illinois. They are also stringing 60 miles for Bechtel Corporation on the same system. Headquarters have been established at Monticello where E. R. Rethjen is in charge, and at Chattsworth where Clifton Hammett is the superintendent.

The company has completed the stringing of 70 miles of 20-in. for Eastern Construction Company on the Lone Star Gas Company's Opelika-Dallas line. The work for El Paso Natural Gas Company out of Kermit, Texas, has been shut down, however, as pipe has not been available. This job consists of stringing 95 miles of 24-in. and is about 35 per cent completed. The field office is at Kermit with L. L. Rowland in charge.

G. G. Griffis Construction Company, Tulsa, Oklahoma, has a contract to lay approximately 57 miles for Northern Natural Gas Company on the loops that company is adding to its system in Kansas, Nebraska, Iowa, and Minnesota.

Anderson Brothers Corporation, Houston, Texas, has received a contract for 59.3 miles of The Texas-Empire Pipe Line Company's 18-in. crude oil carrier between Patoka and Wilmington, Illinois. The company will begin laying pipe at Patoka station sometime this month and work northeastward.

Work also will start this month on 82 miles of 22-in. for Buckeye Pipe Line Company. The new line will parallel Buckeye's existing system from Lima to a point south of Toledo.

This contractor is putting in 201 miles of the Ozark Pipe Line System for Shell and installing crossings of the Mississippi, Missouri, and Gasconade rivers. One considerable obstacle was surmounted with completion of a dual crossing of the Missouri River near St. Charles, Missouri.

Smith Contracting Corporation, Fort Worth, Texas, had completed April 4 about 60 per cent of its work on Shell Pipe Line Corporation's Ozark Pipe Line System. The section consists of 157 miles of 22-in. pipe extending from the Verdigris River, Rogers County, Oklahoma, to Buffalo, Missouri. The contractor is using two spreads and maintaining warehouses and field offices at Vinita, Oklahoma, and Neosho, Missouri. F. A. Smith is general superintendent. Fred Peters is spread superintendent of Section 3, and H. J. McAdams office manager. Myrl Rumsey is in charge of putting in the Grand River crossing. Ben L. Mapes is office manager for Section 2.

Approximately 35 miles of pipe remains to be laid on The Texas Pipe Line Company job between Wichita Falls, Texas, and Cushing, Oklahoma. This is part of the Basin Pipe Line System and consists of 170 miles of 24-in. C. C. Craig is superintendent and H. G. Breckenridge office manager.

Pacific Pipe Line and Engineers, Ltd., Los Angeles, California, has been awarded a contract to lay a 10-in., 10-mile line for Standard Oil Company of California between Wilmington and Torrance.

R. B. Potashnick, Cape Girardeau, Missouri, has been awarded a contract to lay 215 miles of 24-in. pipe line from northwest Louisiana to Fredericktown, Missouri, for the Mississippi River Fuel Corporation of St. Louis, Missouri. Work is scheduled to begin June 1. There will be two spreads, one under the supervision of Garland L. Mims, and the other with Roy Whitworth as spread man.

R. H. Fulton and Company, Lubbock, Texas, began construction April 1 on 130 miles of 26-in. line for the Cities Service Gas Company between Newton and Ottawa, Kansas. This contractor has also just recently begun the laying of 74.5 miles of 26 and 30-in. in Kansas for the Panhandle Eastern Pipe Line Company. The 114 miles of 26-in. being laid for the same company in Kansas is 80 per cent completed (March 25).

Sheehan Pipe Line Construction Company, Tulsa, Oklahoma, announces that work on the 55 miles of 22-in. being laid for The Texas Pipe Line Company between Patoka and Wood River, Illinois, is shut down at present (March 22) due to excessive mud and rain. J. W. Brown is in charge of the job. This contractor is also relocating five lines of 8-in. pipe for Buckeye Pipe Line Company at Bellevue, Ohio, and doing various refinery work at Robinson, Illinois, for The Ohio Oil Company.

Deaton and Sons, Inc., Odessa, Texas, began April 1 the construction of a gathering system at Ulysses, Kansas, for the Stanolind Oil and Gas Company of Tulsa, Oklahoma. The project consists of laying 137 miles of pipe ranging in size from 4 to 22 in. Bill Fogleman is spread foreman.

Eastern Construction Company, Dallas, Texas, has been awarded a contract by the Northern Natural Gas Company to lay approximately 78 miles of loops in Kansas, Nebraska, and Iowa, the work to begin about May 15. The contract includes 9.5 miles of 24-in. in Kansas, 29.5 miles of 24-in. and 21.14 miles of 20-in. in Nebraska, and 17.8 miles of 24-in. in Iowa. Four loops will be laid.

Eastern Construction has completed about 50 miles (April 4) of the 70-mile Lone Star Gas Company line between Opelika and Dallas. J. W. Arthur is superintendent and Fred C. Harwell manager of the field office.

▸ **Edmonds Construction Company,** Cody, Wyoming, has received the contract to build Interstate Oil Pipe Line Company's 70-mile, 12-in. line from Elk Basin field to Laurel and Billings, Montana.

▸ **Ray L. Smith and Sons, Inc.,** El Dorado, Kansas, will construct about 62 miles of the 26-in. line between Clendenin, West Virginia, and Rockville, Maryland, for Atlantic Seaboard Corporation and Virginia Gas Transmission Corporation, both members of the Columbia Gas System.

▸ **E. J. Mahoney Contracting Company,** Mt. Pleasant, Michigan, is laying 75 miles of 12-in. and 20-in. for the Michigan Gas Storage Company. The 20-in. pipe will be laid between Pleasant Lake and Laingsburg, and between Laingsburg and Lansing both 12 and 20-in. will be laid. The job is expected to be completed in June.

▸ **Midwestern Constructors, Inc.,** Tulsa, Oklahoma, announces that 80 per cent of its work on Shell Pipe Line Corporation's Ozark Pipe Line System has been completed (April 5). This work totals 79 miles, extending from Cushing to Chelsea, Oklahoma, and includes crossings of the Arkansas and Cimarron rivers. The rivers crossings have been completed. M. T. (Bill) Wilhite is the superintendent in charge. The field office is at Skiatook.

A contract has been made with the Texas Gas Transmission Corporation of Owensboro, Kentucky, to lay 80 miles of 26-in. pipe in Jefferson County, Indiana, and Warren County, Ohio. R. C. Stanley will be the superintendent in charge and construction work will begin May 1.

For Transcontinental Pipe Line Corporation, Houston, Texas, 15 miles of 30-in. pipe will be double-jointed at a field shop established at Columbia, Mississippi. This is a sub-contract with Fish Constructors, Inc., of Houston, acting as agents for Transcontinental. This is experimental work using the Lincoln submerged arc-welding process.

Another recent contract entered into with Shell Pipe Line Corporation is for the installation of additional piping facilities at the Cushing tank farm. Earl S. Powell is superintendent of this work, which is just beginning.

Additional facilities also are being installed at the Fritch, Texas, gasoline plant and dehydration plant for the Texoma Natural Gas Pipeline Company. J. A. Bard is the superintendent.

▸ **Latex Construction Company,** Houston, Texas, has been at work about a month on construction of four pumping stations on the Basin Pipe Line System, which extends from Jal, New Mexico, to Cushing, Oklahoma. The stations are at Lindsay, Oklahoma; Haskell, Texas; Colorado City, Texas, and Odessa, Texas. J. B. Latham is in charge for the contractor.

This company also is laying 40 miles of 6-in. and 8-in. for The California Company near Ruston, Louisiana. A field office has been established at Ruston with F. A. Silar in charge.

▸ **A. C. Holder Construction Company,** Tulsa, Oklahoma, has laid approximately 100 miles of the 382-mile, 10-in. crude oil line of the Atlantic Pipe Line Company from the West Texas Permian Basin to the lower Gulf Coast of Texas. Only one spread is working inasmuch as Atlantic is in no hurry for the line and no deadline has been set for its completion. The contractor has his field office and warehouse at San Antonio. W. E. Stainback, who is in charge for Atlantic, has his office with the contractor.

United Gas Pipe Line To Spend $15,000,000

United Gas Pipe Line Company contemplates construction expenditures of more than $15,000,000 during 1949, according to the company's annual report. These will include major additions to capacity of existing transmission lines, extensions of new lines to communities not previously served, and construction of gas processing facilities for the production of natural gasoline and other liquid hydrocarbons.

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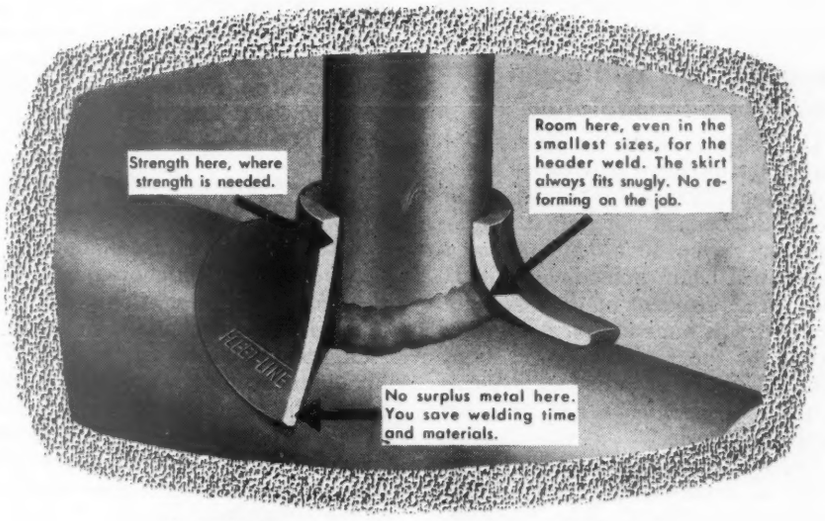
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PIPE LINE PROJECTS

El Paso Would Lay Line Proposed by Affiliate

El Paso Natural Gas Company, in what it described as a move to meet an anticipated shortage of natural gas in the San Francisco Bay area in 1951, has asked the Federal Power Commission to authorize construction of a 451-mile pipe line extending from northwestern New Mexico to a point near the Arizona-California border. This line originally was proposed by San Juan Pipe Line Company, an affiliate of El Paso. El Paso now, however, proposes to construct the facilities as a part of its own system.

The line, the company said, would initially deliver 150,000,000 cu ft of gas daily from fields in the San Juan Basin to the Arizona connection with El Paso's system. From there, the application continues, the gas would be transported to the vicinity of Needles, California, where it would be sold to the Pacific Gas and Electric Company, which distributes gas in the Bay area of California.

The proposed project, to be built at an estimated cost of $28,000,000, would consist of the 541-mile, 24-in. line, approximately 101 miles of feeder line, two compressor stations with a total horsepower of 6300, a natural gasoline extraction plant, and a gas dehydration plant.

Texas Eastern Will Begin New Work Immediately

Construction work on Texas Eastern Transmission Corporation's new expansion program, designed to increase the capacity of its natural gas pipe line system to 740,000,000 cu ft a day, will begin immediately, R. H. Hargrove, president of the company, reported. His announcement followed receipt of the Federal Power Commission's order granting a certificate of public convenience and necessity for the new project.

Texas Eastern will lay 177.5 miles of 26-in. diam pipe line looping the two existing "Inch" lines from the company's Station No. 16, near Labanon, Ohio, to a point approximately 20 miles east of Station No. 19, which is near Summerfield, Ohio, Hargrove said.

At the same time, Hargrove added, 69.5 miles of 20-in. pipe line will be built looping two sections of the Little Big Inch in Texas and Louisiana; and 100 miles of 16-in. line will be laid from the Provident City field in Lavaca County, Texas, to the Baytown, Texas, terminus of the Little Big Inch.

Four new compressor stations will be built on this line at oil pumping station sites near Beaumont and Newton, Texas, and near Many and Castor, Louisiana. These stations will develop a total of 17,500 compressor hp. Changes will also be made at four Texas Eastern compressor stations in Ohio and one in Western Pennsylvania to increase the available power there by an additional 15,000 hp. At the Lebanon, Ohio, site a complete new 5500-hp reciprocating compressor station will be built near the present 14,000-hp centrifugal station. These additions will bring the total number of compressor stations on Texas Eastern's system to 26 and the total effective horsepower of the system to 272,650.

Right-of-way has been acquired for the new pipe line projects in Ohio, Texas, and Louisiana, Hargrove reported. A total of 14,000 tons of 26-in. and 20-in. pipe has already been delivered and distributed at various points along the route. The entire program will require 62,000 tons of steel pipe, 14 new 1000 and 1100-hp gas engines and reciprocating compressor units, and 15 centrifugal compressors with electric motors ranging from 1250 to 2000 hp. Total cost is estimated at $24,052,000.

Cities Service Would Add 4790 Compressor Hp

Cities Service Gas Company, of Oklahoma City, Oklahoma, has asked the Federal Power Commission to authorize the installation of additional compressor facilities aggregating 4790 hp on the company's partially completed 400-mile natural gas pipe line, which, when finished, will extend from the Kansas-Hugoton gas field to Kansas City, Missouri. Estimated cost of the compressor facilities is $1,214,000.

Cities Service said the proposed installations are part of a four-year program for expanding compressor facilities, as originally outlined in 1946 when the company asked FPC to authorize Hugoton-Kansas City line.

Shell Sees Early Completion of Projects

Two of Shell Pipe Line Corporation's largest construction projects are expected to be completed by mid-year, according to T. E. Swigart, president, Shell Pipe Line Corporation, Houston, Texas. Making a progress report on the 500-mile Ozark Pipe Line from Cushing, Oklahoma, to Wood River, Illinois, in which Shell has a 55 per cent interest, and on the Basin Pipe Line from Jal, New Mexico, to Cushing, of which Shell is a one-third owner, Swigart said that both should be in full operation by June, 1949.

When completed, the new lines will provide continuous transportation for crude oil from New Mexico and West Texas, via Oklahoma, to the Wood River, Illinois, area, some 1000 miles away.

According to Swigart, the 20/22-in. segment of the Basin Pipe Line from Jal to Wichita Falls, Texas, has been in operation since last July, and the 24-in. segment extending into Cushing is expected to be completed in May.

West Virginia-Maryland Gas Line Contract Let

Atlantic Seaboard Corporation and the Virginia Gas Transmission Corporation have announced that a 262-mile, 26-in. natural gas pipe line will be laid from Clendenin, West Virginia, to Rockville, Maryland. The H. C. Price Company, Bartlesville, Oklahoma, has been awarded a contract to lay three sections of the line, totaling 200 miles. Starting near Cleveland, West Virginia, these sections will traverse the Great North, Allegheny, and Shenandoah mountains and will extend to the Atlantic Seaboard Corporation's property near Rockville. The contract also calls for two major river crossings, consisting of four 16-in. lines each across the Shenandoah and Potomac rivers.

Harold C. Price, president, and J. P. Neill, vice president of the contracting firm, indicated actual construction work would begin the latter part of April. The line is scheduled to be completed by December 1.

Pipe for the project is being fabricated by the A. O. Smith Corporation of Milwaukee, Wisconsin.

El Paso Natural and PG&E to Lay Lines

In a move to make available to consumer markets natural gas now being vented to the air in West Texas, the Federal Power Commission has authorized El Paso Natural Gas Company and Pacific Gas and Electric Company to construct new pipe line facilities for the transportation of 250,000,000 cu ft of gas a day for ultimate sale in central and northern California.

The new facilities of the two companies, to be built at an estimated combined cost of more than $100,000,000, will bring gas from the Permian Basin in New Mexico and Texas through the El Paso system to a connection with the PG&E line on the Arizona-California border.

Under the authorization, El Paso will construct approximately 247 miles of 26 and 30-in. line looping the company's present 26-in. line from the Permian Basin; about 95 miles of 24-in. line in Texas to reach gas supplies; approximately 102 miles of 26-in. and 17 miles of 30-in. line extending from El Paso's Gila compressor station in central Arizona to the Colorado River, near Needles, California; approximately 80,000 hp in compressor capacity, and additional field lines and equipment. Estimated cost of El Paso's portion of the project is $52,456,032.

PG&E will build 506 miles of 34-in. line extending from the California boundary to its terminal near Milpitas, California, 16,800 hp in compressor units, and additional lateral lines. The 34-in. line is the largest diameter ever authorized for any natural gas pipe line. PG&E estimates cost of these facilities at about $55,519,000.

The FPC order fixed July 1, 1952, as the deadline for completion of construction. Both companies have indicated that they will begin work on the projects immediately.

Asks to Construct 327 Miles of Line

Northern Natural Gas Company, Omaha, Nebraska, is seeking Federal Power Commission authorization to construct and operate additional natural gas facilities that would increase capacity of the company's system north of Kansas by 60,000,000 cu ft of gas daily. Total estimated cost of the project is $27,800,000.

The company proposes to construct a total of approximately 327 miles of pipe line in Kansas, Nebraska, and Iowa; to install 10 compressor units with an aggregate horsepower of 16,000, and to build a dehydration plant at Garden City, Kansas.

Texas Gas Given Permission for Line

Texas Gas Transmission Corporation has been authorized by the Federal Power Commission to build 110 miles of 20-in. pipe line from the Carthage gas field in Texas to Lisbon, Louisiana; 723 miles of 26-in. line from the Lisbon gas field to a connection with the Texas Eastern pipe line near Middletown, Ohio; a lateral line 32 miles from the proposed 26-in. line near Madisonville, Indiana, to a connection with facilities of the Kentucky division near Evansville, Indiana, and ten compressor stations with an initial installed capacity of 68,800 hp.

These facilites will cost $73,500,000 and are expected to be in operation in 1950.

Wyoming Line Planned

Application has been made to the Wyoming Public Service Commission by The Texas Pipe Line Company for permission to lay 122 miles of 8⅝-in. pipe line from the Newcastle area, Weston County, to The Texas Company refinery at Casper. In addition to the main line, a gathering system would be laid, pumping stations erected, and storage facilities constructed. Producing fields that would serve the line include Mush Creek, Fiddler Creek, Osage, Skull Creek, Any Hills, Bridge Creek, and others.

Texas Awards Contracts For 183-Mile Illinois Line

Contracts have been awarded by The Texas-Empire Pipe Line Company for the construction of an 18-in. crude oil line totaling 183.2 miles, from Patoka to Wilmington, Illinois, it was announced by R. B. McLaughlin, president of the pipe line company.

Anderson Brothers Corporation of Houston, Texas, was given the contract to build the first section of the pipe line, which will start at the Patoka station site and extend 59.3 miles northeastward. The contractor is expected to begin on the project upon the receipt of the line pipe, which will be during April.

H. C. Price Company of Bartlesville, Oklahoma, was awarded the contract for the second section of the line, which will begin at the point where Section 1 ends and extend 61.5 miles northeastward toward Wilmington. The same contractor also was given the contract to build the third section of the line, which will extend 62.4 miles northeastward to Wilmington station.

Work is due to begin about April 15 on the second and third sections.

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Miles of Pipe laid, 16" and larger 306
Miles of Pipe laid, 8", 10" and 12" . . . 62
Miles of Pipe taken-up and reconditioned . . 50

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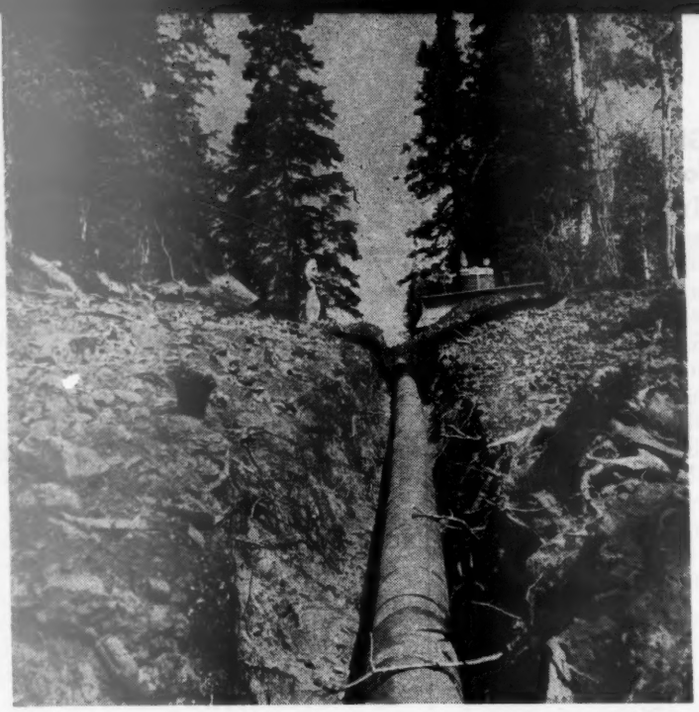
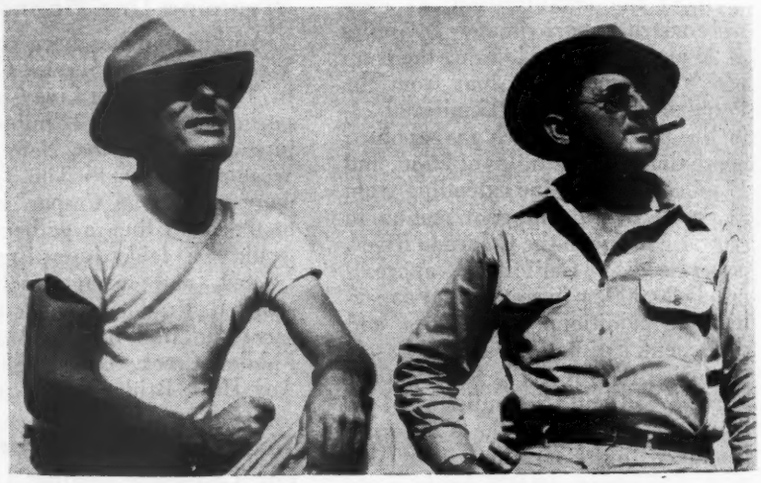


Backfilling a section of the new Rangely-Salt Lake pipe line near Wolf Creek Pass summit, laid by Pacific Pipeline and Engineers, Inc., for Salt Lake Pipe Line Company.

M. E. Shifflet, left, spread foreman for J. R. Horrigan Construction Company, and Kelly Evans, inspector for Ford, Bacon & Davis, on the Michigan-Wisconsin Pipe Line Company's project from the Hugoton field to distribution points in the states of Michigan and Wisconsin.



These pipe liners of the Bridgeport area of The Ohio Oil Company, received service award emblems and certificates at a supper given in Lawrenceville, Illinois. Attending guests and recipients of recognition are, first row, left to right: Joe Dean, personnel supervisor; J. L. Armstrong; Earl S. Mardis, Bridgeport division superintendent; R. A. Ernst, acting Stoy superintendent, and Roy P. Wesley.

Second row: James J. Dunn; Leslie C. Young; Robert Fitzgerald, superintendent; O. F. Moore, vice president and manager of the pipe line department; Earl Parks; Edward Burns; Leroy Taylor; Ernest Wesley, C. E. Fiscus, and David Miller.

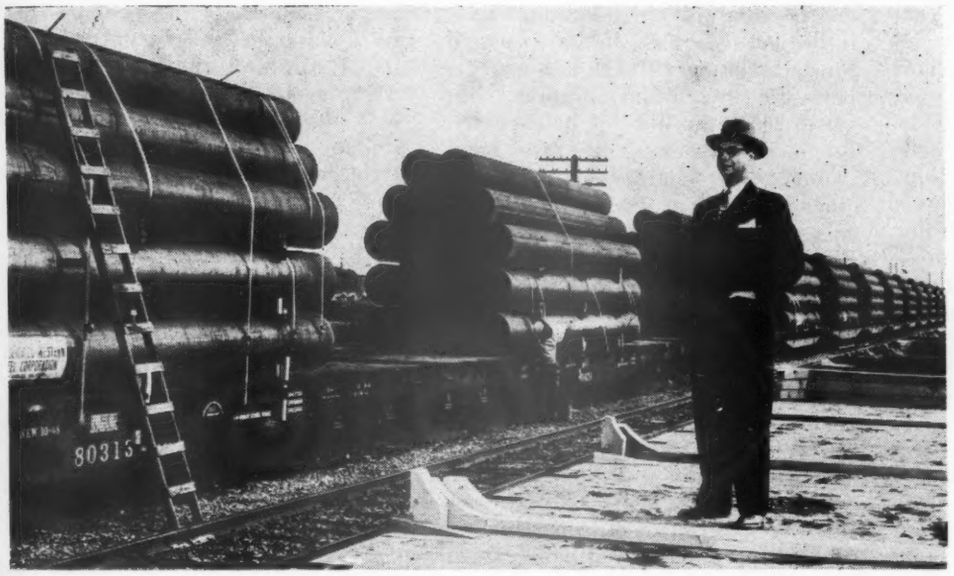
Third row: George Pulley, assistant Bridgeport division superintendent; J. S. Harvey; E. M. Weger; Byrl P. Moody; Dale Schell; Homer Settlemeyer; Maurice Magee; James Rankin; William Gallagher; David Fisher; Charles Stivers; Fred Ramsey; Homer Matthews and Z. Mitchell.

Fourth row: T. M. Jones; Silas Dean; Jack Van Alman; Virgil Vandament; Leo Flick; Philip Graf; Joseph Allen; Anthony Cardinal; Harley Brown; Frank Hetzler, assistant Bridgeport division superintendent; and Delaska Ennes.

Photo Courtesy The Beacon

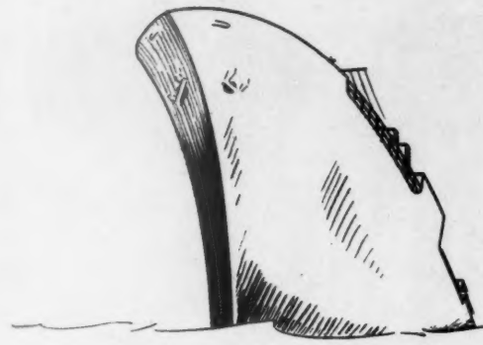
Pictorial

Day crew at Hope, Arkansas, station of Texas Eastern Transmission Corporation. Left to right, K. G. Russell, oiler; J. D. Hamilton, oiler; H. F. Hart, relief operator; M. B. Lipscomb, mechanic; J. S. Draper, chief operator.



Claude A. Williams, president of Transcontinental Gas Pipe Line Corporation, on hand to see the first shipment of 100 carloads of pipe being transported over the Santa Fe Railway from Los Angeles to Texas. The pipe will be used for construction of the longest pipe line in the world running from Texas to New York—a distance of approximately 1840 mi. The pipe is being fabricated by Consolidated Western Steel Corporation. Approximately 20,000 carloads of pipe will be used.

General committee for the Southwestern Gas Measurement Short Course, held this month at Norman, Oklahoma. Left to right: M. D. Gilbert, Pittsburgh Equitable Meter Division, Rockwell Manufacturing Company, Tulsa, Oklahoma; J. W. Sanders, chief engineer, Arkansas Oil and Gas Commission, El Dorado; E. L. Stark, Foxboro Company, Dallas, Texas; James L. Griffin, Northern Natural Gas Company, Omaha, Nebraska; T. S. Whitis, Amarillo Oil Company, Amarillo, Texas; Miss Kate A. Niblack, Oklahoma Utilities Association, Oklahoma City; C. E. Terrell, Southern Natural Gas Company, Birmingham, Alabama; W. H. Carson, dean, College of Engineering, University of Oklahoma, Norman; W. A. Brewster, Arkansas Louisiana Gas Company, Shreveport, Louisiana; W. H. Woods, Gulf Oil Corporation, Houston, Texas; B. F. Worley, United Gas Corporation, Shreveport; George E. Greiner, Phillips Petroleum Co., Bartlesville, Okla.; Earl Kightlinger, Arkansas Louisiana Gas Co., Shreveport, and Dean Bruce, Oklahoma Natural Gas Co., Tulsa, Okla.



MARINE OPERATIONS

Estimate of Suez Canal Tanker Traffic for 1952

Acceding to a request from the Suez Canal Company, the American Embassy in Cairo, Egypt, recently prepared an estimate of tanker traffic through the Suez Canal for the year 1952. As Suez Canal tanker traffic is almost totally concerned with Persian Gulf trade, the Embassy estimate was based on ratios using January, 1948, Persian Gulf oil production, and scheduled Persian Gulf oil production for Januay, 1952, as well as January, 1948, Suez tanker traffic to and from the Persian Gulf ports. The same proportions were worked out using July, 1948, tanker and production figures, assuming that by January of 1952 the Trans-Arabian pipe line would be in operation.

The results of this study indicated that the January, 1948, production total in the Persian Gulf attained 860,000 bbl per day and 248 tankers traversed the Canal; on July, 1948, production reached the total of 1,130,000 bbl per day and 392 tankers traversed the Canal. The relative increase in west-bound movements from the Persian Gulf apparent in the January-July figures was due primarily to ECA trade; increase in East Indies production for Far East markets; increase in U. S. imports, and the Haifa refinery shutdown. Embassy estimates of Suez tanker traffic are shown in the following table:

Period		Total T-2 Tanker traffic	Daily Average
Jan.—1948		248	8
July—1948		392	13
Jan.—1952	(Estimated)	528 (Min.)	17
		760 (Max.)	24

As several oil companies are now building new giant-sized super-tankers for use on long hauls, the American Embassy report indicated that it would be reasonable to assume a decrease of 25 per cent in estimated tanker movement for 1952 to reflect the increase in the carrying capacity of super-tankers. This diminution in traffic would not, however, affect Suez Canal receipts because tanker charges are based on storage capacity.

Recent announcement of projected Canal improvements by the directors of the Suez Canal Company indicates that the number and size of ships using the Canal are constantly increasing, and this, in the main, was ascribed to the considerable increase in tanker traffic between the Middle East and Europe. The Suez Canal, however, reports the "Syren and Shipping," has yet to reach the limit of its capacity, for under present conditions of navigation, ships could follow one another at less than quarter-hour intervals, whereas they are only arriving at Port Said and Suez on an average of one every two hours. It is no longer possible to let ships proceed though the Canal individually. Consequently, it has been found necessay to group ships in convoys of varying size, but as there is still in the northern sector of the Canal a stretch some 60 miles long without any widening, the Suez Canal Company, has decided to cut out of the desert a six-mile-long bypass canal approximately 30 miles from Port Said, which would allow convoys to pass in complete safety. This project will involve the removal of nearly 18,000,000 cu yd of soil and will take between two and three years to complete. It is estimated that the new bypass will reduce by several hours the time ships have to wait for a convoy to form. Tankers will thus be able to transit the Canal under the best possible conditions both with safety and speed.

The Suez Canal Company has further decided to deepen the Canal by 20 in. over its entire length to allow the passage of the largest tankers now building having a draft of up to 35 ft. This deepening will involve the removal of 8,000,000 cu yd of underwater soil and 800,000 cu yd of rock and will take from four to five years to complete.

It is further reported that the tanker mooring station in Lake Timsah will be deepened and anchorage facilities at Port Said will be enlarged to permit the berthing of 18 ships of 660 ft, compared with 9 ships of 330 ft that can be accommodated at present.

New Antwerp Oil Port

A new oil port is to be constructed at Antwerp, which will include mooring facilities, storage accommodations, and refineries, according to a recent announcement. The new port will double the tanker mooring capacity of Antwerp, and with a constant water level will offer a great advantage over the existing main mooring installations, which are situated on the right bank of the River Scheldt above Antwerp and are thus subject to tides.

Tanker Construction In British Yards

Sunderland's eight shipyards at the present time have on hand orders for 80 ships, of 707,600 dwt. Norway is the largest customer for new Wear-built tonnage, and at the moment there are under construction, or under order, 12 vessels of 191,500 tons for Norwegian owners, of which ten are tankers of 15,000 tons and upward. There are five ships on order at Sunderland for U. S. owners and others for Swedish, Danish, Polish, Dutch, and Portuguese owners. Of the tonnage on order, no fewer than 449,550 tons represent 36 tankers, an indication of the swing toward specialized tonnage that has occurred on the river, and a sharp contrast with prewar days when Sunderland constructed a large percentage of tramp shipping.

From the Blythswood Shipbuilding Company, Ltd., Scotstoun, comes the report that the new oil tanker *British Progress*, has run official trials on the Firth of Clyde. Built to the order of the British Tanker Company, Ltd., the tanker has been constructed on the combined transverse and longitudinal system. Of 12,500 dwt, the dimensions of the *British Progress* include, 463 ft bp by 61 ft 6 in. breadth and 34 ft moulded depth. Recently launched at the Wallsend shipyard of Swan, Hunter and Wigham Richardson Ltd., was the motor tanker *Staland* for the Aktieselskapet Havtank, of Oslo, Norway. Main dimensions of the vessel are: length bp 465 ft; breadth moulded 63 ft 6 in., and depth moulded 36 ft 3 in.

MEASUREMENT OF MUD VISCOSITIES AT HIGH TEMPERATURES

● **Introduction.** The abnormal behavior of drilling muds in wells drilling through high temperature formations and the general tendency toward higher temperature with increased depth of wells made it desirable to study the effect of high temperatures on the viscosity of muds in the laboratory.

As commercial instruments for this purpose were not available it was necessary to design one for the specific purpose. The viscosimeter was already in the process of construction when the present writer was assigned to complete the instrument and was fortunate enough to overcome the basic stumbling block—evaporation of water from the sample.

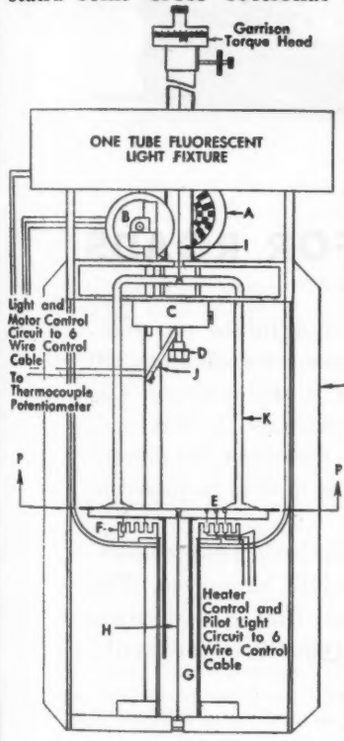
● **Stroboscopic high temperature viscosimeter.** Basically, the instrument is a torsion type viscosimeter in which the torque, transmitted from an inverted rotating cup through the sample to a concentric stationary cup, is proportional to the viscosity of the sample. The general construction is patterned after an early type of Garrison viscosimeter.

The rotating cup speeds are controlled by selective gear reduction and variable speed motor. The speeds are registered by a stroboscopic disc on the driving motor. This provides six speeds, 800, 600, 400, 200, 150, and 100 rpm, giving a wide range of rates of shear so that thixotropy or gelling of the mud may be indicated by its apparent viscosity at the different rates of shear. A number of variable speed viscosimeters have been described in literature but none, to the writer's knowledge, that can be operated for extended periods of time at substantially elevated temperatures. Structural and electrical details are shown below.

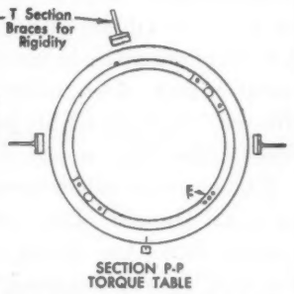
To avoid any irreversible temperature effects on the mud a series of temperature-viscosity determinations is always started at the lowest temperature. The thermostat selector switch at the base of the constant temperature block, is set on Position 1, corresponding to 80 F (No. 2—120 F, No. 3—160 F, No. 4—200 F). To limit power input to the heaters a Variac transformer is used. A toggle switch turns on the power to the unit and lights the fluorescent lamp that provides the stroboscopic illumination.

Taken from the article of the same title by V. N. Bednarski that was presented before the Spring Meeting of the Pacific Coast District, Division of Production, American Petroleum Institute, Los Angeles, California, May 6-7, 1948, and published in *The Petroleum Engineer*, October, 1948, pages 192 to 204, inclusive.

FIG. 1. High temperature viscosimeter stand semi-cross-sectional views.



A—Stroboscopic disc geared to motor.
B—Variable speed motor to drive spindle.
C—Selective gear box 1:1, 4:1 gear ratio and neutral.
D—Spindle connects to viscosimeter cup rotor.
E—Viscosimeter block control cable female plug.
F—Concentric mercury contact channels.
G—Oil damping chamber.
H-I—Lower and Upper torsion wires.
J—Thermocouple slip ring contact brushes.
K—Torque table suspension yoke.



NOTE: The one tube fluorescent light provides the constant frequency flicker needed to give a stroboscopic effect with light and dark segmented disc.

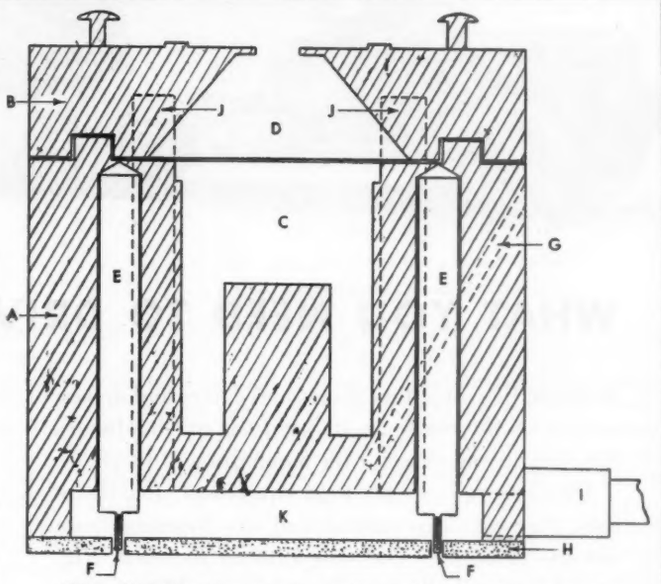
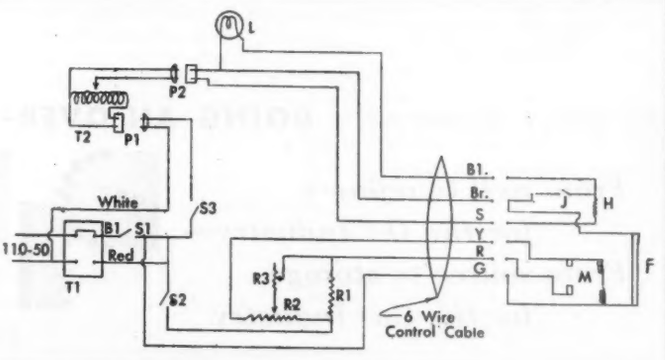


FIG. 3. Elevation cross section viscosimeter constant temperature block high temperature viscosimeter.

A—Solid Aluminum Block Machined to Dimensions.
B—Solid Aluminum Cover—(Split).
C—Cavity for Sample Cup.
D—Cavity in Cover for Mercury Seal.
E—Adjustable Cartridge Thermostats.
F—Thermostat Adjusting Screws.
G—Thermometer Well.
H—Transite Board.
I—Control Cable Plug.
J—Cartridge Heaters, K Cavity for Wiring and Thermostat Selector Switch.

FIG. 2. Schematic wiring diagram of high temperature viscosimeter control box.

T1—Sola constant voltage transformer.
S1—Master and light switch.
S2—Motor switch.
S3—Block heater current switch.
R1—Fixed motor speed control resister—500 ohm.
R2-R3—500 and 5 ohm coarse and fine motor speed control rheostats.
T2—Variable autotransformer to control power to block heaters.
P1-P2—Polarized plugs so that autotransformer may be removed from circuit.
L—Block heater pilot light.
H-J—Block heater and thermostat (only 1 of 4 sets shown).
M—Variable speed motor to drive spindle.
F—Fluorescent Light.



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MEASUREMENT OF MUD VISCOSITIES AT HIGH TEMPERATURES

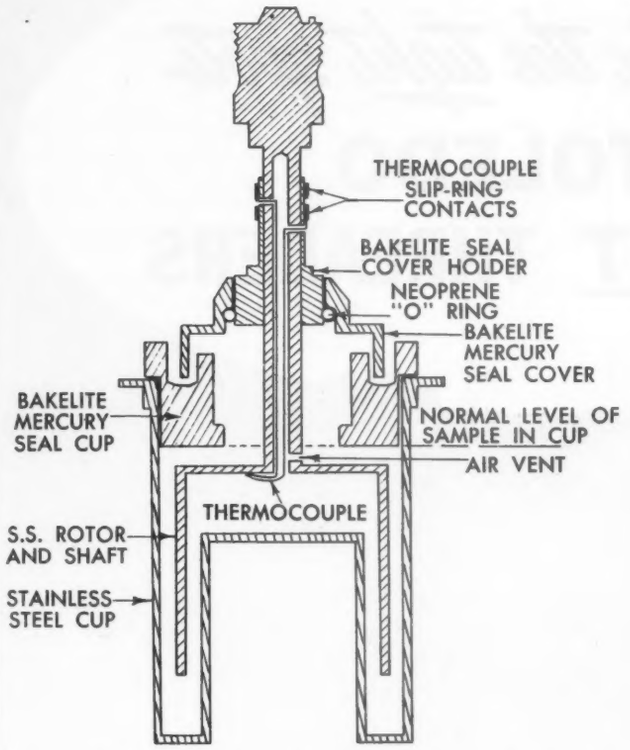
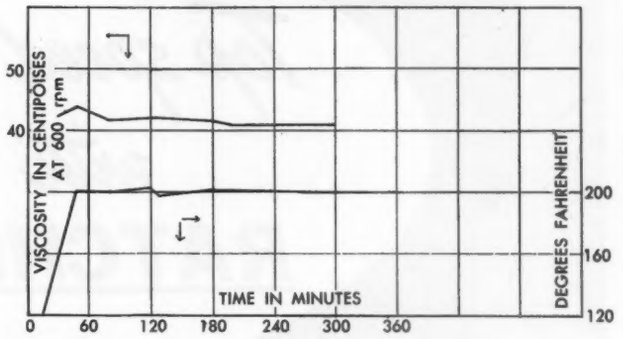


FIG. 6. Elevation cross section. Cup and rotor assembly high temperature viscosimeter.

FIG. 10. Time-temperature stability of a temperature stable clay.



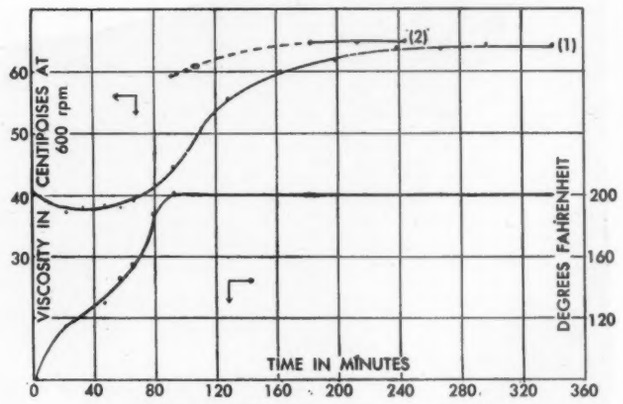


FIG. 11. Time-temperature stability of a temperature unstable clay.

The mud sample is brought to temperature equilibrium at 800 rpm before taking a given set of torque readings at 800 and lower rates of rotation. Temperature equilibrium is indicated by a constant value of the rotor thermocouple on two readings at least five minutes apart. The temperature equilibrium having been established, a torque reading is made at 800 rpm by turning the torque head until torque table and stationary marks coincide. Because of a certain amount of inertia of the heavy block (12 lb) it is necessary to displace the table angularly so that it oscillates a little. If the marks coincide after the table comes to rest twice the torque reading is considered valid and the rotor is slowed to the next lower speed. For 600 and 400 rpm this is accomplished by slowing the motor until the middle then the outer stroboscopic rings, respectively, become stationary. For the 200, 150, and 100 rpm speeds a 4 to1 gear in the spindle is engaged and the motor again run at 800, 600, and 400 rpm stroboscopic speeds.

Each time the speed is reduced between determinations an interval of ten minutes is allowed for the mud to come to equilibrium before a torque reading is taken.

When the complete set of torque readings at a given temperature is completed the spindle speed is changed to 800 rpm and the thermostat selector switch changed to the next higher temperature throughout the system.

In order to speed the rate of heating between selected temperatures the Variac transformer is advanced to 110 or 135 volts until a temperature within 5 F of that desired is indicated on the block thermometer, the Variac is then adjusted to a satisfactory operating voltage that gives minimum fluctuation in the temperature of the block, thus 65 volts at 120 F, 85 volts at 160 F, 95-100 volts at 200 F.

● **High temperature stability.** The stability of operation at high temperature and the time required to reach equilibrium may be demonstrated as follows: Fig. 10 shows viscosity and temperature curves for a relatively temperature inert clay over a period of five hours. The temperature curve rises rapidly to 200 F and remains constant. The viscosity curve fluctuates slightly then remains constant within experimental error for nearly 3½ hr. If any evaporation of water had taken place there would have been a steady rise in viscosity.

Fig. 11 shows the temperature and viscosity curves for a temperature unstable clay. Viscosity curve 1 shows the progressive changes in viscosity starting from 80 F as the temperature was raised to and maintained at 200 F. The continuous increase in viscosity after the block reached the desired temperature is not due to lag in temperature between the sample and the block but rather due to velocity of reaction of the clay to temperature. Tests have shown that the sample is at equilibrium temperature within ten minutes after the block reached the desired temperature. Again the viscosity levels off to a constant value above which it does not rise showing that evolution of water does not take place.

Viscosity curve 2 is another sample of the same mud and very nearly of the same base viscosity (within 2 centipoises) that had been put through the steps outlined in "Operation of the Instrument." Then after the 200 F determinations had been completed the temperature was left at 200 F and the sample stirred for 20 min at 800 rpm then dropped to 600 rpm for 30 min and the viscosity noted. The first point on the curve is that originally determined in the regular procedure. The second point is that noted after the 30 min noted above but actually some 90 min after the initial determination. The third and fourth points are further observations 30 min apart.

Taken from the article of the same title by V. N. Bednarski that was presented before the Spring Meeting of the Pacific Coast District, Division of Production, American Petroleum Institute, Los Angeles, California, May 6-7, 1948, and published in *The Petroleum Engineer*, October, 1948, pages 192 to 204, inclusive.

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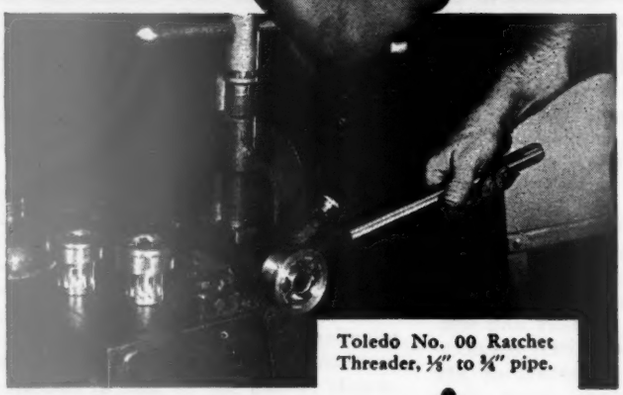
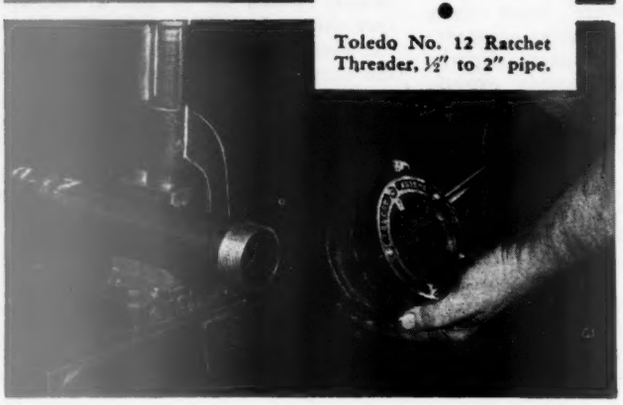
Toledo No. 11 Ratchet Threader, ½" to 1¼" pipe.



Toledo No. 00 Ratchet Threader, ⅛" to ¼" pipe.



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MEASUREMENT OF MUD VISCOSITIES AT HIGH TEMPERATURES

● **Preparation of mud samples.** The mud samples were prepared by mixing clay and tap water in 3-gal glass pickle jars, with a variable Lightning mixer, to 45-50 sec API funnel viscosity 1500 cc in—1000 cc out. The samples were then allowed to hydrate overnight in an 80 F cabinet. The samples were then adjusted with water, if necessary, to fall within 45-55 sec viscosity range. No further adjustments were made although some of the clay muds developed a higher funnel viscosity on further standings. The muds were thoroughly stirred with the mixer before removing samples for viscosity-temperature determinations.

● **Some temperature-viscosity results:** The graphical data are presented in two sets of curves. One set illustrates the change in viscosity with temperature at constant rpm, the other the change in viscosity with reciprocal of shearing rate or $\frac{1}{\text{rpm}}$ at constant temperature by the Garrison method.[1] The first set shows a straightforward temperature - viscosity relationship at various speed of rotation. Here the 600 rpm values may be taken to be equivalent to Stormer centipoise viscosities at 80 F they are known to correspond within a few per cent. The second set indicates the change in thixotropic or gelling properties with change in temperature.

Although the general form of the viscosity-temperature curves appears common to all, there is sufficient individual variation between clays so that some might be preferred to others in drilling operations where high hole temperatures are expected. Selecting the best base clay is not the whole answer but it is a step toward improved high temperature mud technology.

It is hoped that instruments of the type described here will materially assist those engaged in solving mud problems in the normal as well as the high temperature range.

● **Conclusions.** A torsional type, high temperature, viscosimeter (patterned after an early type Garrison viscosimeter) has been successfully operated to measure the effect of temperatures on mud viscosity up to 200 F at atmospheric pressure.

Typical temperature-viscosity effects on a number of clay muds are presented to indicate the possible effects of high temperature formations on drilling muds.

1. "A Study of Some Phases of Chemical Control in Clay Suspensions." A. D. Garrison and Ten Brink, *AIME Transactions*, 136, 175 (Tech. Pub. 1124, 1940).

Taken from the article of the same title by V. N. Bednarski that was presented before the Spring Meeting of the Pacific Coast District, Division of Production, American Petroleum Institute, Los Angeles, California, May 6-7, 1948, and published in *The Petroleum Engineer*, October, 1948, pages 192 to 204, inclusive.

FIG. 16

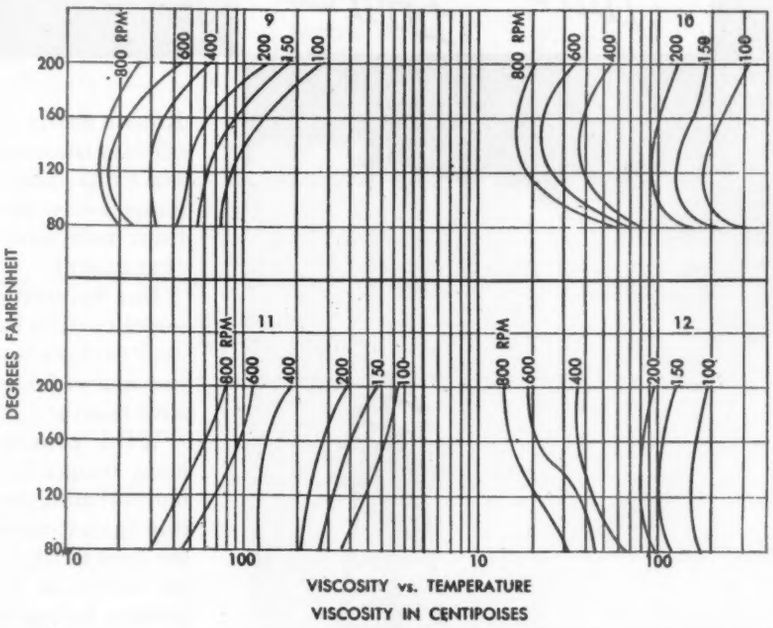
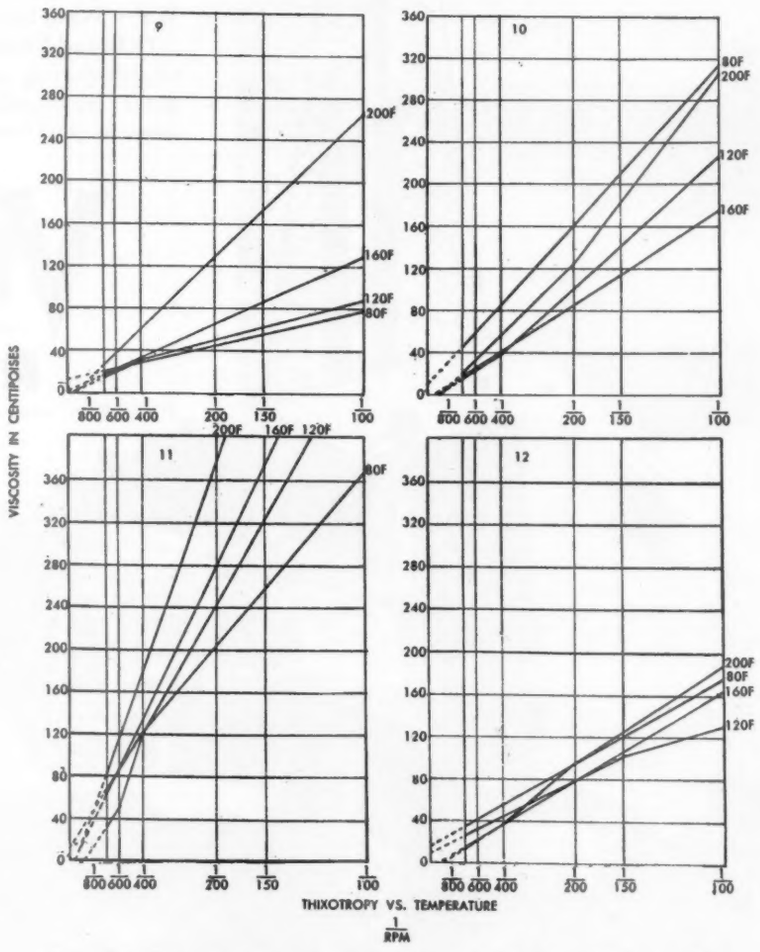


FIG. 17



Four clays in a group representative of clays making useful muds in the 78 to 85 lb per cu ft (10.4-11.4 lb per gal) range. (Original article presents curves on three other groups.)

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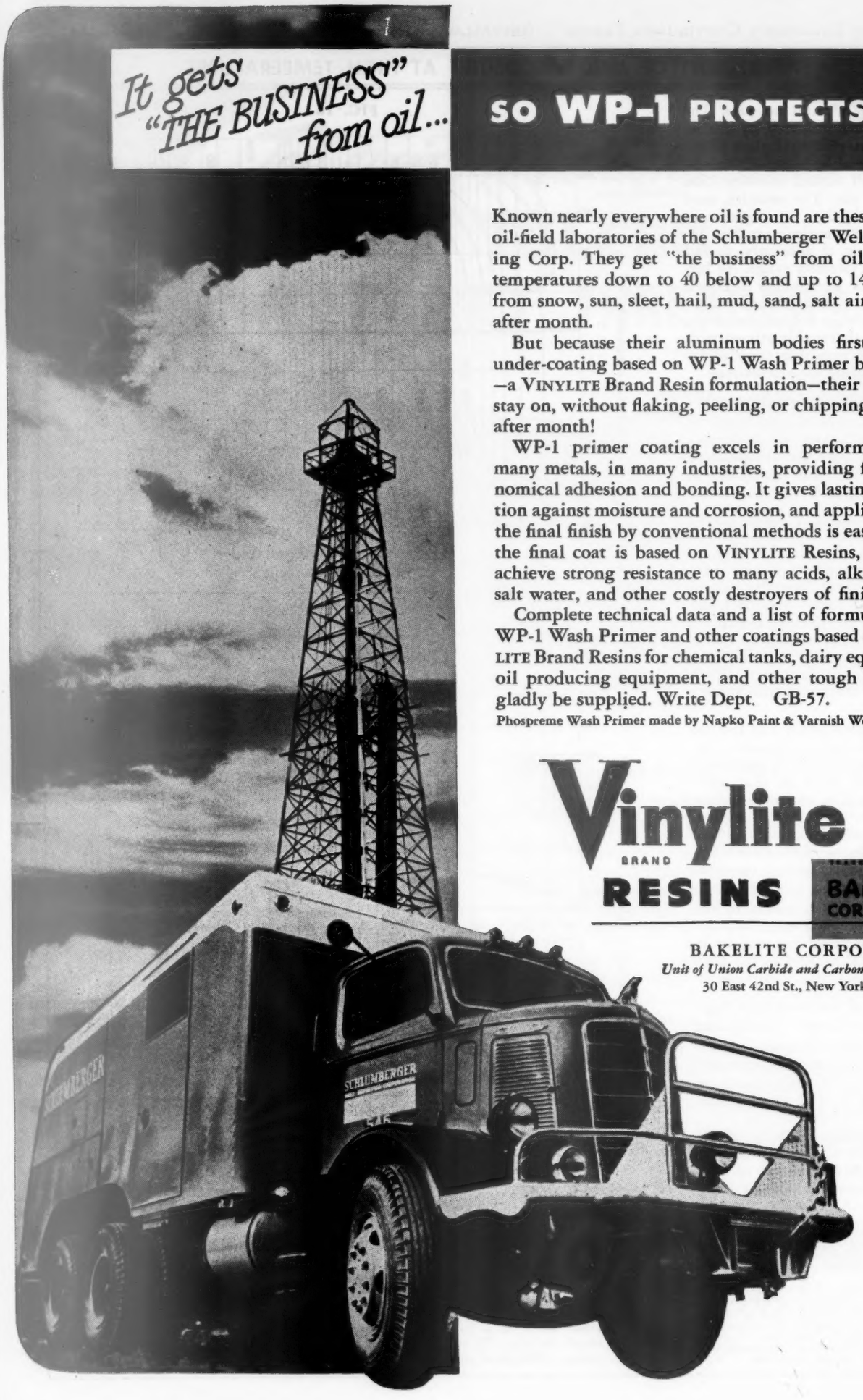

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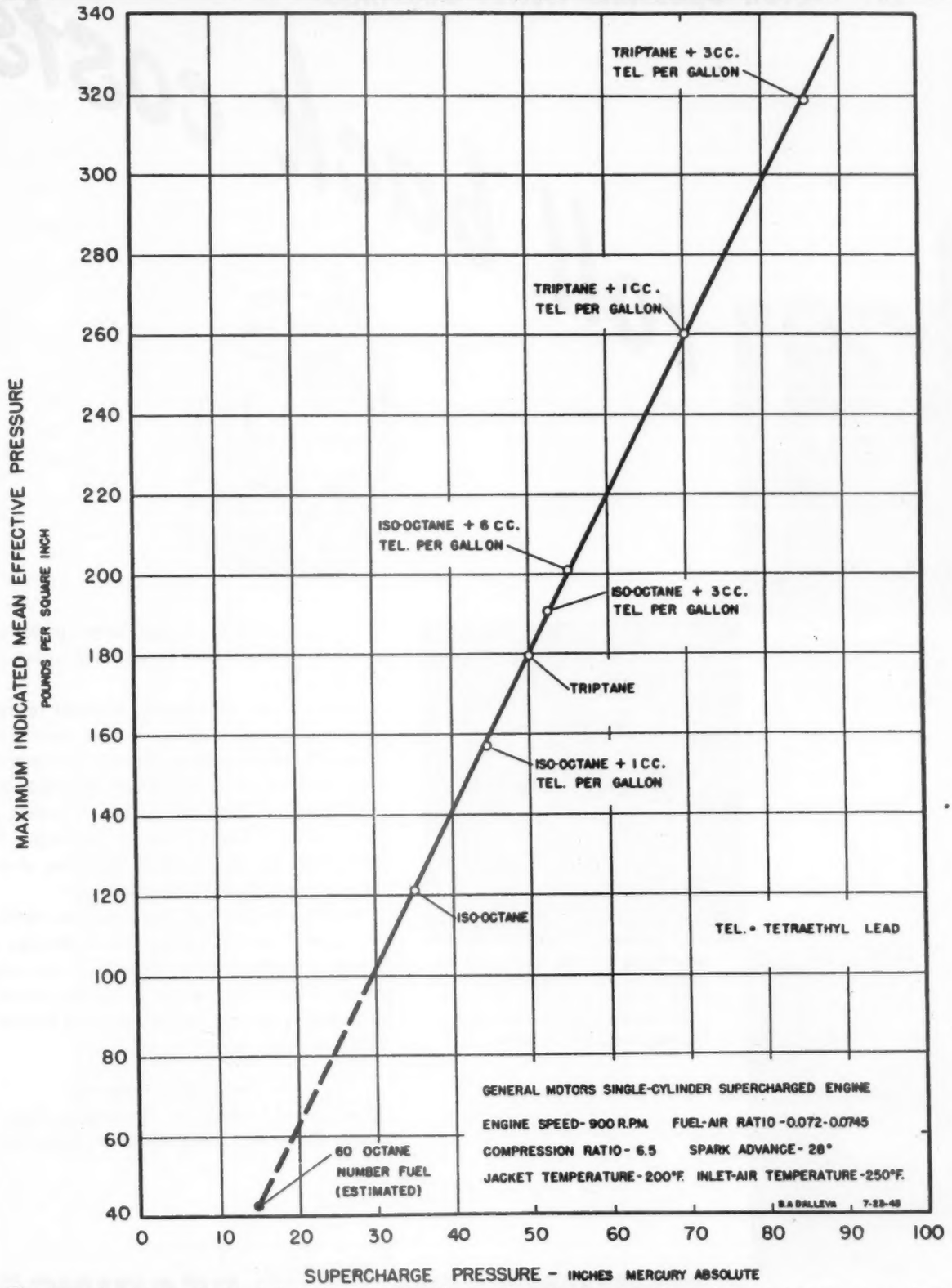
EFFECT OF MOLECULAR STRUCTURE OF ENGINE FUELS



The chart above shows the knock-limited power obtainable from a particular but probably fairly representative supercharged engine with varied amount of supercharge pressure, for several fuels. Here the concern is with the upper range of fuels, and iso-octane of 100-octane number is near the bottom of the chart. The power obtained with leaded triptane is nearly three times as great as with iso-octane.

Taken from the paper, "The Effect of Molecular Structure of Fuels on the Power and Efficiency of Internal Combustion Engines," presented by Charles F. Kettering, vice president, General Motors Corporation, before the American Chemical Society in September 1944.

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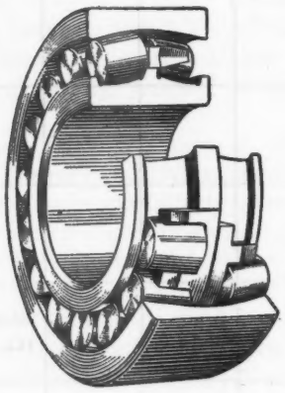

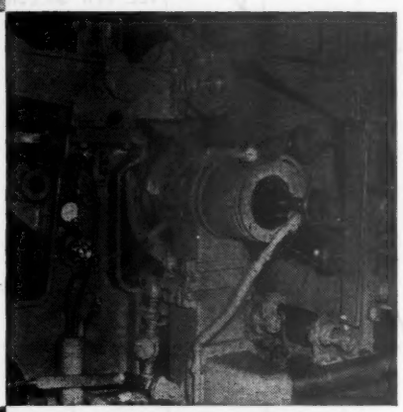

Beloit gets accurate initial and running alignment of suction press rolls with Spherical Roller Bearings. Maintenance costs go down because bearings need less attention.

Robins Car Shakeout eccentric shafts are mounted on Torrington Spherical Roller Bearings. Power requirements are negligible, thanks to the smooth operation of these self-aligning bearings.

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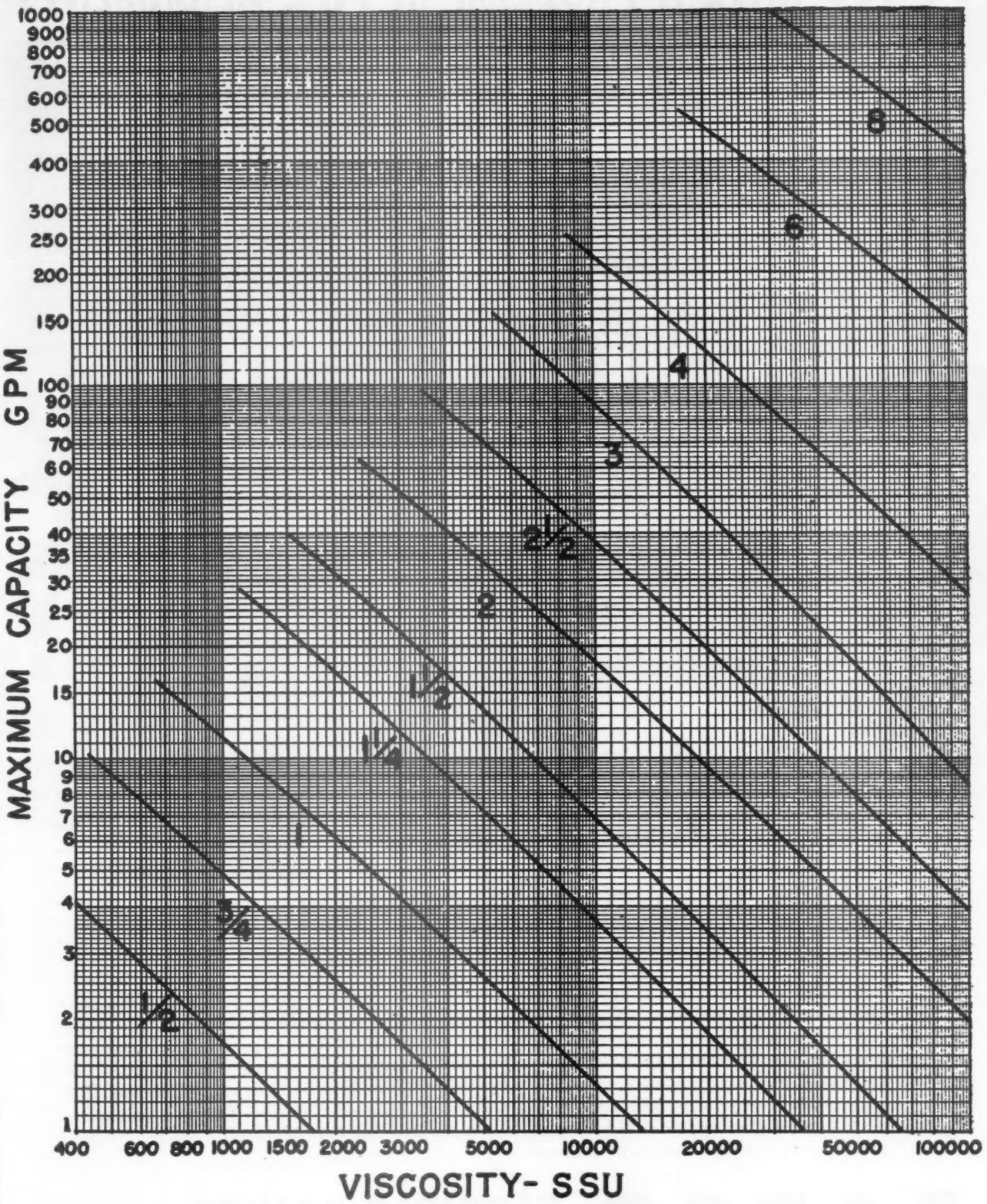
SIZE OF SUCTION PIPING FOR VISCOUS LIQUIDS



Where no static suction lift exists, a quick check to determine whether a suction line is large enough may be made by reference to the chart above. This chart shows the recommended maximum capacity of non-volatile liquids, which can be handled through an average 10 ft of smooth standard suction pipe plus two standard elbows and one gate valve. These lines represent a suction pipe friction loss of 7½ psi equivalent to approximately 15 in. Hg suction lift. If there is a static suction lift or the line is not simple, a larger suction pipe will be required.

It is recommended that the capacity indicated by the upper end of each line be not exceeded through any size suction line, as that would result in excessive pipe line velocities.

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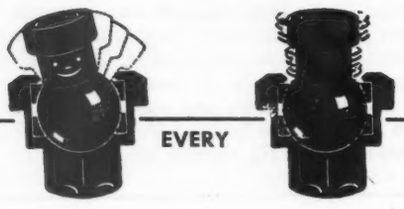


"MOVE IN EVERY DIRECTION"

INTERFACIAL MIXING CHARACTERISTICS

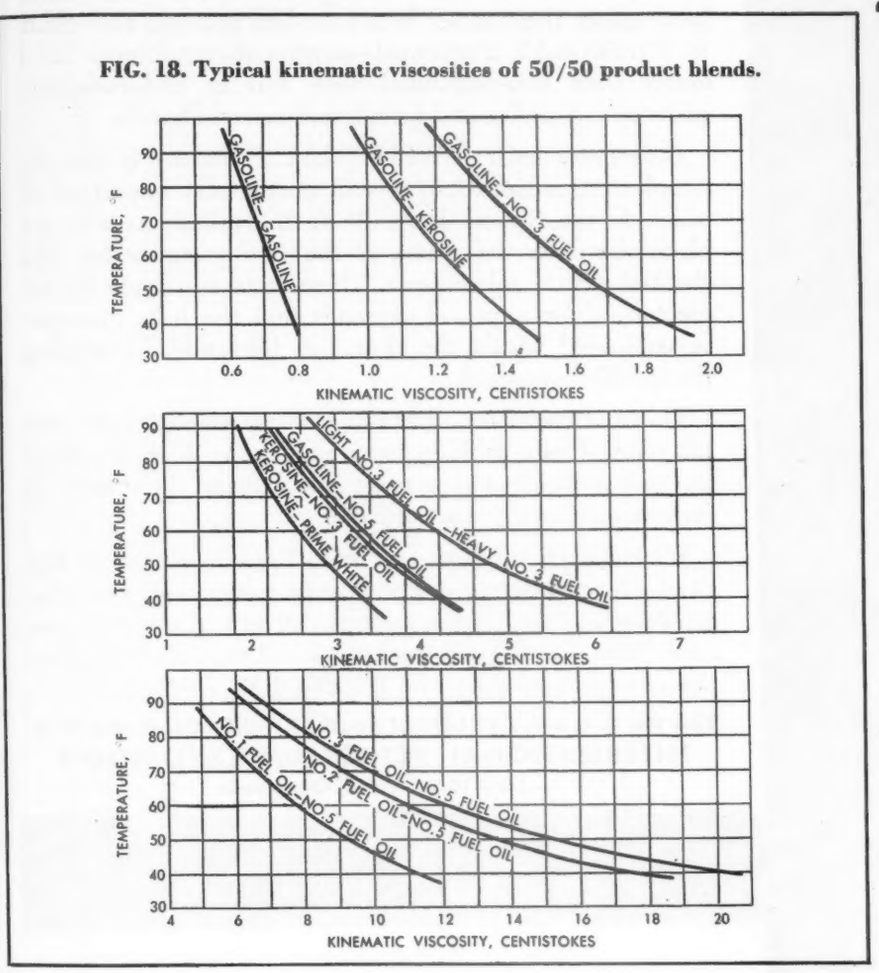

TEMPERATURE, °F
KINEMATIC VISCOSITY, CENTISTOKES
GASOLINE–GASOLINE
GASOLINE–KEROSINE
GASOLINE–NO. 3 FUEL OIL
GASOLINE–NO. 5 FUEL OIL
KEROSINE–NO. 3 FUEL OIL
KEROSINE–PRIME WHITE
LIGHT NO. 3 FUEL OIL–HEAVY NO. 3 FUEL OIL
NO. 1 FUEL OIL–NO. 5 FUEL OIL
NO. 2 FUEL OIL–NO. 5 FUEL OIL
NO. 3 FUEL OIL–NO. 5 FUEL OIL

FIG. 18. Typical kinematic viscosities of 50/50 product blends.

To assist in the easy solution of mixture problems we have made up a chart of viscosities of 50/50 mixtures of the now common materials handled in products lines shown on Fig. 18. These were made to cover our own materials, but the major specifications of similar liquids in other companies in all likelihood will show only minor differences, and these charts should be usable on most problems where it is inconvenient to make laboratory determinations of kinematic viscosities of the actual mixtures.

Our Reynolds Number calculations were in English units. This is another nuisance calculation, so again we made a simple nomograph of Reynolds Numbers for straight edge calculations, and it is hoped that this will be helpful in the solution of these problems. This is shown in Fig. 19.

Earlier in the paper mention was made of the characteristic sine wave form of the composition curve of product mixtures when plotted as a function of specific gravity and throughput. This constitutes the most useful tool we have in handling cuts between products and may be used in two simple ways. The first is shown diagrammatically in Fig. 20, which illustrates a typical sine curve with a portion of it representing a mixture curve as it arrives at a pipe line terminal. In actual practice this curve can be predicted within close limits of accuracy if the batch head is observed by gravitometer or hand sampling as it transits the line and before it arrives at our project terminal. In dispatching office routine this plot can be made up before arrival within limits of accuracy probably better than our usual spot sampling methods. My co-author of this paper, Russ Schulze, who, unlike me, is a mathematician, assures me that Fig. 20 is usably accurate. *See Sheet 5.*

Taken from the article, "Interfacial Mixing Characteristics of Products in Products Pipe Line," by S. S. Smith and R. K. Schulze, Shell Oil Company, Inc., and printed in *The Petroleum Engineer*, October, 1948, pages 330 to 337 inclusive.

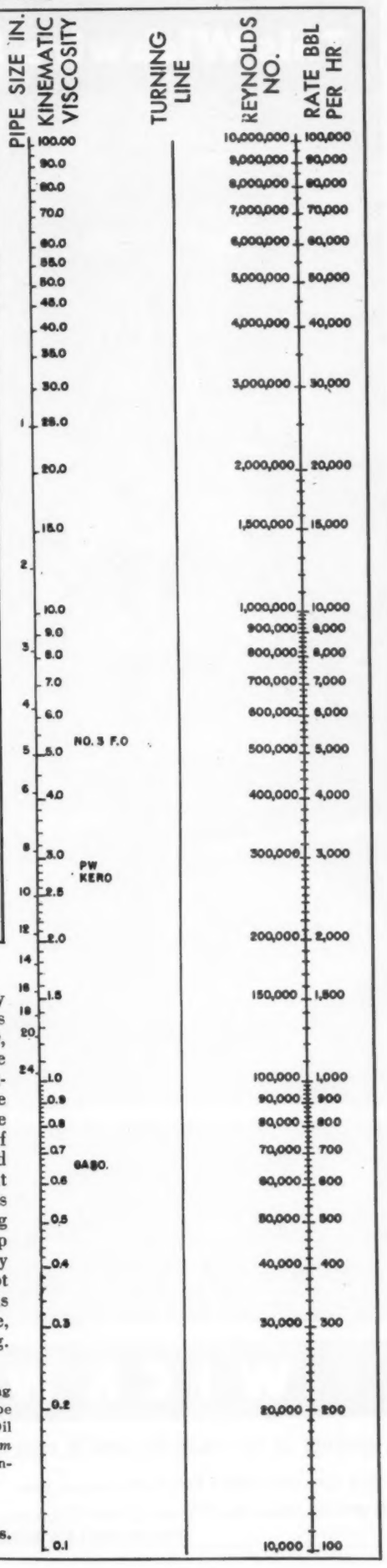
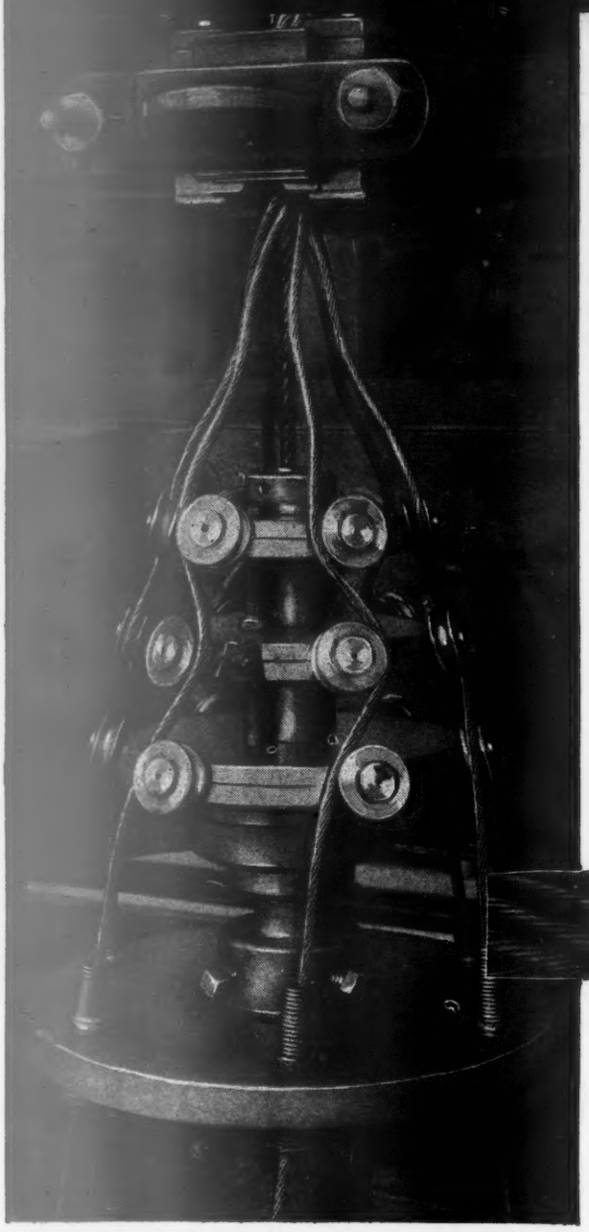


FIG. 19. Nomograph Reynolds Numbers.

This Wickwire Rope Gets a Permanent Wave



Passing strands of Wickwire Rope through a special roller head causes them to set in a wave-like pattern. The result is WISSCOLAY *Pre*formed—a rope that not only lasts longer than non-preformed rope, but is kink-resistant; easier to cut, splice and install, and safer to handle.

Before any order of WISSCOLAY *Pre*formed is run off, samples are subjected to several tests—most important of which is the Strand Helix Test. Individual strands are placed between the plates of the testing apparatus and checked with a micrometer. These tests are made by inspectors whose approval demands that the helix diameter be controlled within the closest of tolerances in meeting the specified standard.

This and countless other tough tests, coupled with over 125 years of wire-working know-how, make Wickwire Rope the logical choice of rope users who demand the utmost in performance, safety and long life.

Wickwire Distributors and Wire Rope Engineers in key cities everywhere are ready to help solve your wire rope problems and to provide prompt delivery of the rope you need. Wickwire Rope is available in all sizes and constructions—both regular lay and WISSCOLAY *Pre*formed.

Visit the C. F. & I. EXHIBIT at Booths 109-110, Oklahoma Bldg.

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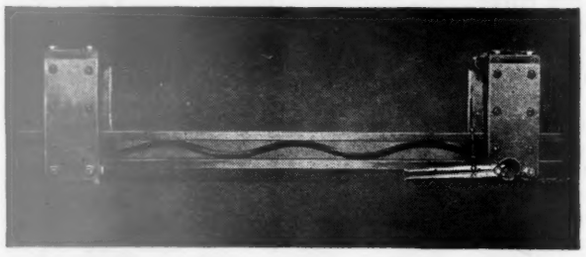

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Thousands of wire rope users have found that the information packed in the pages of "Know Your Ropes" has made their work easier. It's full of suggestions on proper selection, application and usage of wire rope. It's easy-to-read and profusely illustrated. For your free copy, write—Wire Rope Sales Office, Wickwire Spencer Steel, Palmer, Massachusetts.

WICKWIRE ROPE

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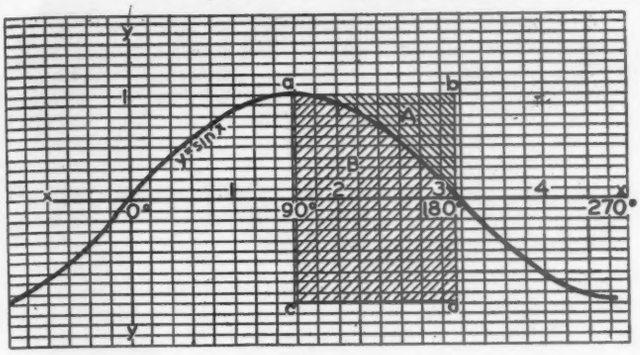
INTERFACIAL MIXING CHARACTERISTICS

FIG. 20. Analysis of a typical sine curve showing the theoretical percentage of product mixture with cuts at the 50 per cent and 25 per cen points of total mixture.



AREA UNDER CURVE ABOVE X AXIS BETWEEN 90° AND 180° $= \int_{90°}^{180°} \text{SIN} \times dx = -\text{COS} \times \Big]_{90°}^{180°}$

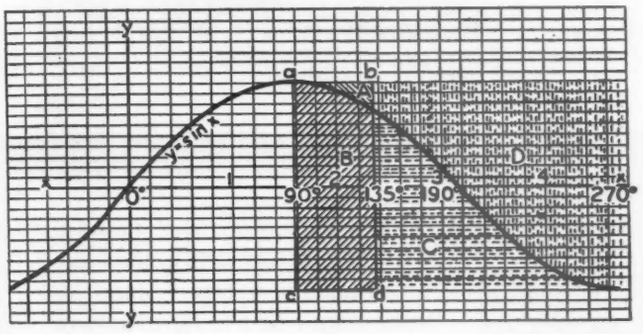
$= 1$

THEREFORE AREA $A = 1 \times \frac{\pi}{2} - 1 = 0.5708$

AND RATIO OF AREA A TO TOTAL AREA

$A + B = \frac{A}{A+B} = \frac{0.5708}{2\left(1 \times \frac{\pi}{2}\right)} = 0.1817$

Gravity change from pure product to 50 per cent mixture represented by area "A" equals 18.17 per cent of total area A + B as determined by integration of sine curve.



AREA UNDER CURVE ABOVE X AXIS BETWEEN 90° AND 135° $= \int_{90°}^{135°} \text{SIN} \times dx = -\text{COS X} \Big]_{90°}^{135°}$

$= 0.7071$

THEREFORE, AREA $A = 1 \times \frac{\pi}{4} - 0.7071 = 0.0783$

AND RATIO OF AREA A TO TOTAL AREA

$A + B = \frac{A}{A+B} = \frac{0.0783}{.2\left(1 \times \frac{\pi}{4}\right)} = 0.0498$

AREA $C = \int_{135°}^{180°} \text{SIN} \times dx + 1 \times \frac{3\pi}{4} - \int_{180°}^{270°} \text{SIN} \times dx$

$= -\text{COS} \times \Big]_{135°}^{180°} + 2.356 - (-\text{COS} \times) \Big]_{180°}^{270°}$

$= 0.2929 + 2.3562 - 1$

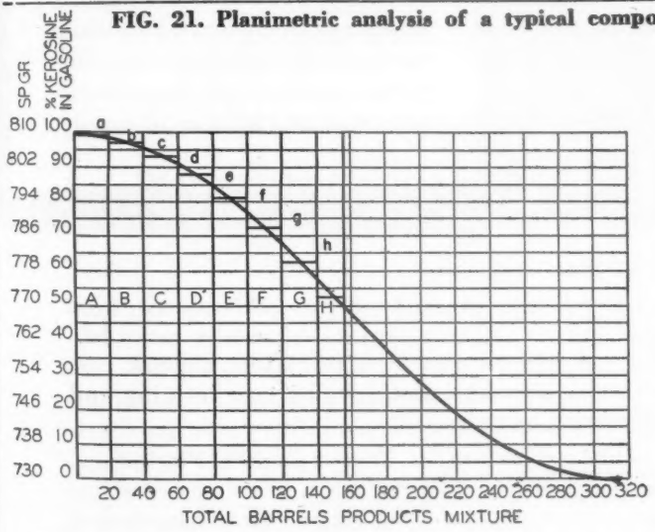
$= 1.6491$

THEREFORE, RATIO OF AREA C TO TOTAL AREA

$C + D = \frac{C}{C+D} = \frac{1.6491}{2 \times \frac{3\pi}{4}} = 0.3499$

Gravity change from pure product to 25 per cent mixture represented by area "A" equals 4.98 per cent of total area A + B as determined by integration of sine curve. Remaining 55 per cent mixture represented by area "C" equals 34.99 per cent of total area C + D.

FIG. 21. Planimetric analysis of a typical composition curve to determine point of product cut.



COMPOSITION OF MIXTURE

	BARRELS GASOLINE			BARRELS KEROSINE	
Area	Volume	Cumulative Total of Area	Area	Volume	Total
a	.2	.2	A	19.8	19.8
b	.6	.8	B	19.4	37.2
c	1.4	2.2	C	18.6	57.8
d	2.4	4.6	D	17.6	75.4
e	3.8	8.4	E	16.2	91.6
f	5.5	13.9	F	14.5	106.1
g	7.5	21.4	G	12.5	118.6
h	7.6	29.0	H	8.4	127.0

EXAMPLE—FROM THE ABOVE TABLE.

IF A CUT IS MADE AT 50% GRAVITY CHANGE (SP. GR. 0.770) A MIXTURE CONTAINING 29.0 BARRELS OF GASOLINE AND 127.0 BARRELS OF KEROSENE WOULD BE OBTAINED.

Cont'd. from Sheet 4. In Fig. 20 it will be seen that a mid-gravity cut point at our project terminal will take only 18 per cent of the total mixture as non-specification product into the alternate product tank. If a cut point at 25 per cent of the mixture is taken in order to better protect the specification of one more vulnerable product, the amount of non-specification product taken into the specification product will be reduced to 5 per cent of the total mixture, with a resultant increase of specification product into the other and less vulnerable one of 35 per cent. This is the easier way to use the sine curve of product change.

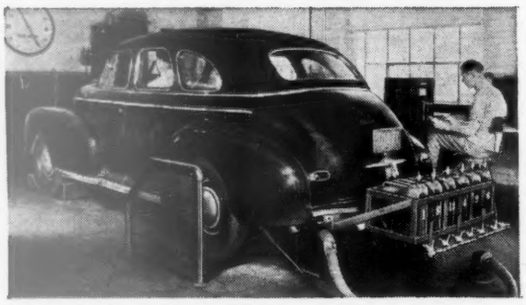
A slightly more complex method that avoids any difficult mathematics and may be tailored to fit the problem is shown in Fig. 21, where, by simple plotting of a kerosine - gasoline product change curve into units of 10 or 20 bbl, it is possible to arrive at the exact number of barrels of non-specification product to be cut either way.

Taken from the article, "Interfacial Mixing Characteristics of Products in Products Pipe Line," by S. S. Smith and R. K. Schulze, Shell Oil Company, Inc., and printed in *The Petroleum Engineer*, October, 1948, pages 330 to 337 inclusive.

Cinderella's Pumpkin

Petroleum Progress has helped turn it into America's Family Coach

THE "horseless carriage" founded a mighty industry. 40 million motor vehicles now travel America's more than half-a-million miles of highways. Out of Texaco research and enterprise have come ever better automotive gasolines and lubricants . . . plus many important ways to conserve petroleum resources through higher gasoline yields from the crude, and the discovery of new sources of supply.



Car on modern chassis dynamometer originated by Texaco which approximates road-driving conditions in the laboratory.

•To achieve finer products, better performance, hundreds of Texaco research workers constantly make laboratory and field tests on fuels, lubricants, engines, cars and other equipment, and develop new refining and manufacturing methods.

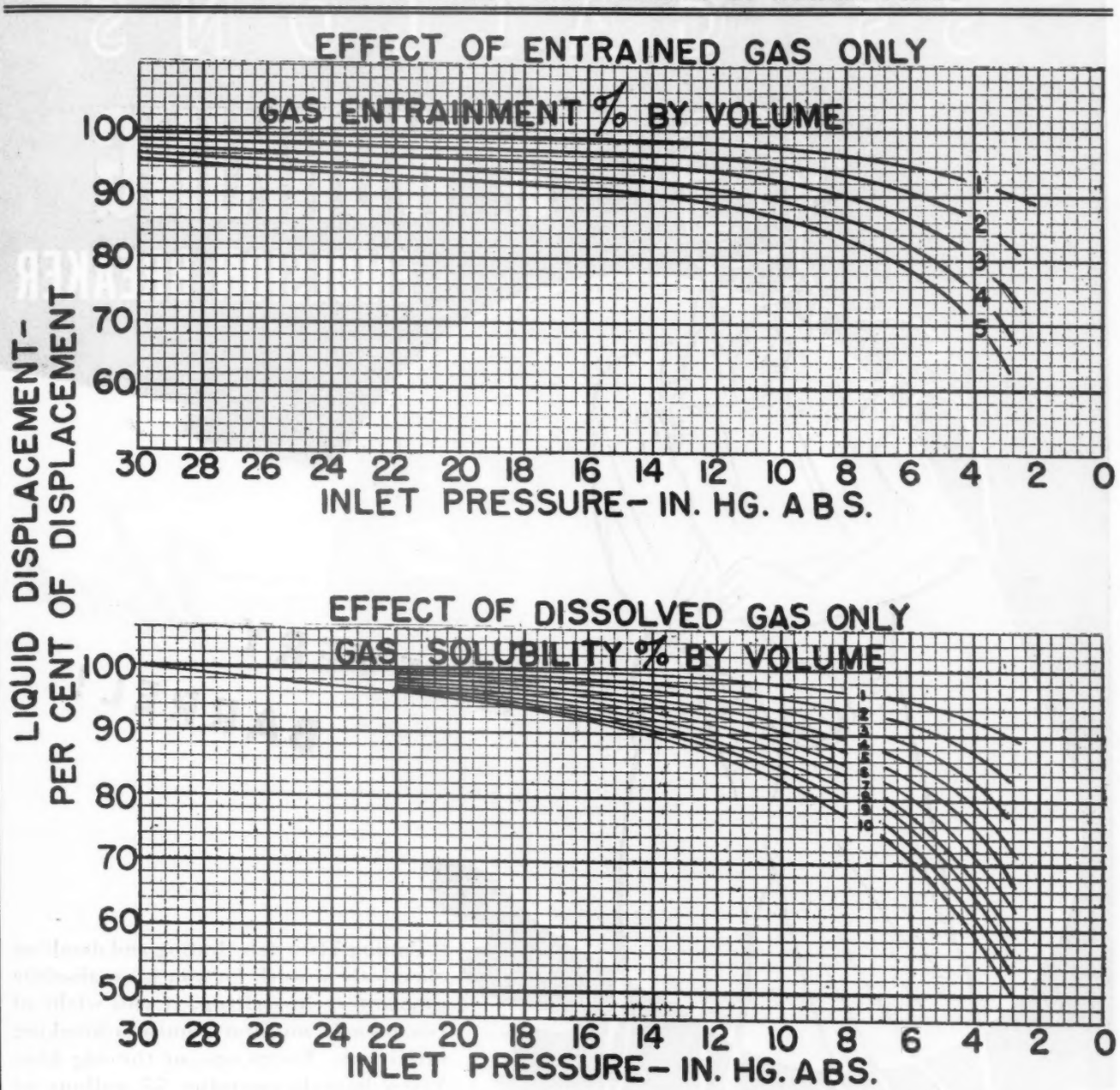
To achieve conservation, Texaco pioneered in thermal cracking and other important ways to increase gasoline yields . . . is currently developing an effective method of producing fuels from natural gas, coal, and other carbonaceous products.

THE TEXAS COMPANY

Petroleum Promotes Progress

TEXACO REG. T. M.

EFFECT OF GASES ON LIQUID DISPLACEMENT OF ROTARY PUMPS



THE EFFECT OF SLIP, PUMP CLEARANCE VOLUME, AND PUMP SUCTION INLET LOSSES ARE NOT INCLUDED IN EITHER CHART.

Most liquids, particularly petroleum oils, because of their viscosity and affinity for air and other gases, are susceptible to air or gas entrainment.

Many factors are associated with the amount of entrained air that can exist in a given installation. It is prevalent in systems where the liquid is circulated repeatedly and during each cycle is exposed to air or is mechanically agitated in air. It is also found in systems where the pump handles a quantity of air either intentionally or by accident. Its presence is indicated by bubbles on the surface of or in the liquid, and, in extreme cases, by the formation of a thick layer of foam.

Besides being capable of entraining air, many liquids are known to contain air or gas in solution. The solubility of air in liquids varies with the type of liquid, time, and conditions of exposure to atmosphere, etc. Lubricating oils at atmospheric pressure and temperature may contain up to 10 per cent of dissolved air by volume; under similar conditions, gasoline may contain as much as 20 per cent in solution.

Entrained and dissolved air or gas in liquids handled by rotary pumps are the most important factors affecting pump performance, both mechanically and hydraulically, especially where reduced inlet pressure exists. When rotary pumps are operated with inlet pressure below atmospheric, entrained gas in the liquid will expand and take up part of the pump displacement, thereby reducing its liquid capacity. Where the liquid contains dissolved gas and the pump inlet pressure is reduced, the gas is freed and expands, thereby reducing the pump liquid capacity.

The liquid displacement of rotary pumps is reduced at least in direct proportion to the amount of air or gas present at the inlet flange of the pump. Actually, the reduction is greater depending on the amount of pump clearance volume and the reduction in pressure inside the pump.

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NOTICE: Visco Products Company is authorized to manufacture and sell Visco Oil Treating compounds for use in the breaking and resolving of oil emulsions, and to grant licenses for such use, under the following United States patents: 1,880,562; 1,880,563; 1,912,330; 1,927,259; 2,050,620; 2,050,640; 2,200,589; 2,214,783; 2,214,784; 2,226,189; 2,302,414; 2,307,313; 2,318,034; 2,318,035; 2,321,054; 2,355,854. Re. 20,717 and patents pending. Any purchaser of Visco Oil Treating compounds is authorized to use the same in the treating, breaking and resolving of oil emulsions in accordance with the above patents. The royalty for such use is included in the purchase price. Visco Products Company is authorized to and is willing to grant licenses on a royalty basis, to all companies, and to others desiring to practice the patented subject matter, under any and all of the above patents, permitting the user to purchase the oil treating compounds at will from any vendor, and to prepare the compounds for use under the above patent or patents, at a royalty charge of 20 cents per gallon. Application for license should be made to Visco Products Company, Houston, Texas.

new and improved machinery and equipment

A REGULAR FEATURE
appearing in
THE Petroleum Engineer
Irwin-Keasler Building
Dallas 1, Texas

(1) Check Valve

Val Corp of Houston, Texas, announces the production of an entirely new type check valve. This valve gives a positive seal even after sealing surfaces have been damaged by corrosion or fluid cutting. It seals successfully even against paraffin deposits.

The Val Corp check valve is easily renewed. Instead of replacing the entire valve, you simply remove the bonnet and replace the screen and packer cup. It is not necessary to remove the valve from the line.

(2) Safety Valve

The FarriSeal Bellows, a new type of safety valve construction that completely isolates the lading fluid from the valve spring chamber and guide surfaces, has been announced by Farris Engineering Corporation, Palisades Park, New Jersey, manufacturers of safety, relief and pinch valves and hydrotorque.

FarriSeal Bellows, or flexible joint, completely seals the spring, guides, adjusting screws, etc., from the vapor or fluid in the body of the valve. The guide cannot become fouled under any conditions, the maker claims. Also, corrosion becomes completely minimized.

(3) Weld-Time Meter

A new weld-time meter for measuring the duration of welding current has been developed by Westinghouse. This unit has the following advantages: (1) It is portable and can be carried easily in one hand. (2) It is a direct reading instrument which totals the weld time and gives values in seconds and cycles. (3) It has a calibrating device built-in so that it does not need a separate source of supply, and can be built directly onto the welding machine or control. (4) It is insensitive to heat control.

(4) Instrument Pen

A new development, announced by the Chartomatic Company of Los Angeles, is a controlled-flow, automatic instrument pen, that operates in a closed system, hence does not tend to clog because of dust or dirt accumulation. This pen will operate for several months without renewing the ink supply, and its feed is controlled by capillary action to promote constant and consistent inking. The pens are made of stainless metal and in consequence are fully resistent to corrosion. They may be employed singly, or in multiple with vari-colored inks, and are so designed that they can be easily installed on almost any type of recording instrument.

(5) Ductile Cast Iron

A new engineering material described as ductile cast iron, which combines the process advantages of gray cast iron, such as fluidity, castability and machinability, with the product advantages of cast steel, has been developed by International Nickel Company. Closing the gap between cast iron and cast steel, this material is characterized by a graphite structure in the form of spheroids, free from graphite in the flake form. Its excellent physical properties, particularly high elastic modulus, high yield strength and ductility, suggest its suitability for many applications hitherto considered beyond the scope of cast iron.

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35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50		
51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66		

NAME..... TITLE.....

COMPANY NAME.....

STREET ADDRESS.....

CITY..... ZONE NO..... STATE.....

(6) Well Servicing Unit

The International Derrick and Equipment Company has designed and built a Rambler Rig oil well servicing unit which is powered by a LeTourneau Tournapull. The Ideco trailer is attached to the Tournapull by means of a gooseneck, thereby creating an integral unit with great maneuverability.

The well servicing unit can get into very small well locations and has its own power unit.

The trailer has a sixteen-wheel bogie, utilizing a walking beam construction. The gooseneck of the trailer was designed to allow ample clearance for the big rubber tires of the Tournapull and thus enable it to assume a 90 deg angle from the trailer. The mast is telescopic, having a 63 ft height in the clear when extended, by means of a hydraulic ram. The mast pipe racking platform automatically extends into position as the mast is raised. The Rambler Rig is equipped with two screw jacks and has a deadline spooling drum between the lower members of the frame. Another innovation consists of the use of a hydraulic motor for extending the telescopic section.

(7) Venturi Tubes

Republic Flow Meters Company announce the design of fabricated Venturi tube assemblies for line sizes between ¾ in. and 3 in. These are supplied with welding ends, with stub end welding nipples for measurement connections. They can be furnished in steel, stainless steel, Monel, brass, bronze or any other metal which can be obtained in tubular and bar forms, and which can be readily welded or brazed.

These tubes are particularly useful where line fluid velocities are so high that excessive differential range is required with an orifice plate, or where solids in suspension in the line fluid tend to deposit in the space immediately ahead of or after an orifice, or on the orifice plate itself.

(8) Whiteprinter

A new large volume Whiteprinter has just been announced by the Charles Bruning Company for use in engineering and business offices with a large volume of duplicating work. This machine reproduces anything drawn, typed, written, or printed upon translucent mediums, at speeds up to 105 sq ft per min. Prints from post card size up to those 42 in. wide and any length are made on the same machine with equal ease.

Volumatic Model 93 produces direct positive prints from the original without intermediate steps.

(9) Wellcheckers

Production of a new-type horizontal wellchecker with automatic water knockout and pilot controls which prevent fluid from ever spilling over into gas line, has been announced by the Rolo Manufacturing Company, Houston, Texas.

R. F. Franklin, president of Rolo Manufacturing Company, stands beside the latest type Rolo horizontal wellchecker, Model No. 1H-2406. This unit, according to manufacturer's statements, will handle 1000 bbl of fluid and 300 MCF of gas per day.

According to R. K. Franklin, president of the company, the new type of pilot control prevents the separator from ever losing fluid seal and also prevents fluid from spilling over into gas run. This pilot will operate satisfactorily on either a fluid or gas supply medium.

(10) Connectors

Mines Equipment Company connectors with integrally molded Neoprene rubber construction have many inherent advantages over the usual molded phenolic or metal encased types. Moisture, oil and dust are automatically sealed away from connections by patented face construction. Mines connectors can't crack when dropped and won't shatter under hard blows. One piece molding of cable to plugs reinforces this vital junction and prevents wire fraying and separation.

(11) Hand Level

Preliminary engineering and construction surveys of all types can now be made more swiftly and accurately with a new improved hand level recently developed by the Brunson Instrument Company.

New features include the incorporation of the level vial inside the instrument to eliminate the usual inconvenient protrusion. Adjustment of the instrument is pre-set and maintained by spring tension regardless of rough handling.

(12) Aquatower

An Aquatower in the 7½ ton bracket has been added to the Aquatower line by The Marley Company, Inc., manufacturers of water cooling equipment. Like the other seven Aquatowers, the new model has these desirable features: Compactness, quiet operation indoors or out, all-steel construction, bearing housing with grease-packed ball bearings, nail-less removable redwood filling, and many other advancements in cooling tower design.

(13) Diesel Engine

Production of a new supercharged Cummins diesel engine for industrial applications has been announced by Cummins Engine Company, Inc., Columbus, Indiana. The newest addition to the Cummins line develops 225 hp at 1800 rpm.

Offering proved Cummins advantages of low fuel cost, dependable operation and long engine life, this model has a horsepower rating never previously offered.

(14) Top Compression Ring

A top compression piston ring, which is twice as strong and has 50 per cent more "spring" than such rings now on the market, has been developed by Koppers Company, Inc.

The new ring is engineered around a new Koppers-developed alloy, called K-spun, and is produced by a special centrifugal casting process.

(15) Hardfacing Alloys

The Air Reduction Sales Company has announced the immediate availability of a complete new line of hardfacing alloys. Divided into three primary groups, ferrous alloys, cobalt base alloys and tungsten carbide, there are a total of fifteen Airco hardfacing alloys available. Especially developed to combat abrasion, impact, heat and corrosion, the new Airco hardfacing alloys will increase the work-life of equipment from two to twenty-five times.

(16) Gas Burner

The John Zink Burner Company's short flame vertical bi-mix gas burner operates on all gases. The design of this burner is extremely simple, sturdy, and easy to install. Each section has two radiating armed spiders. Each spider has an individual mixer. The mixers aspirate a sufficient quantity of primary air to always insure a short flame.

The operator has perfect control over the amount of flame fire. Slugs of water, oil or gasoline blowing through them or running down over them will not damage the burner.

(17) Oil Burners

Peabody Engineering Corporation semi-automatic oil burners with capacities from 75 hp to 600 hp are built around the exacting requirements of Central Station steam generating fuel oil burning equipment. For the first time the builders and owners of small capacity boilers are offering a practical, compact, wide-range mechanical atomizing heavy oil burning system at a cost that is in line with the boiler it is designed to fire.

This burner series is a complete system of fuel oil pumping and oil preheating equipment, forced draft blower and a wide-range, constant differential mechanical atomizing oil burner all mounted on a compact steel base ready to be bolted to the boiler front plate. The unit is provided with outlets for connection to the fuel oil storage tank and electric power supply. Further provisions are the forced draft fan and oil pump motor, gas-electric ignition system, flame failure protection device, automatic electric fuel oil heaters for cold starting and an automatic modulating steam pressure controller.

(18) Dynamometer

Hydraulic dynamometers, designed, built, and used by the Wagner Electric Corporation, have now been made available to electric motor repair shops and other establishments where accurate load-testing of motors is an important operation. Designed especially for this purpose, the dynamometer has proved itself a practical, workable piece of shop equipment, and one that is surprisingly simple to use.

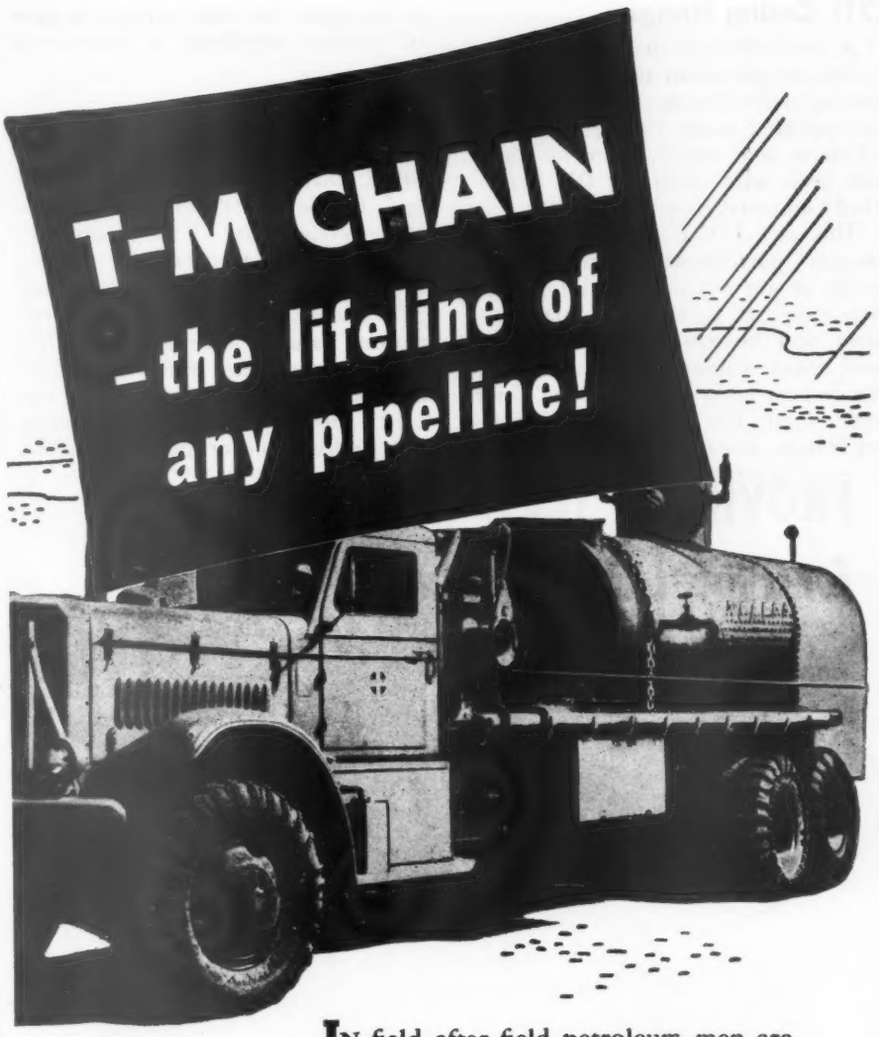
(19) Superchest

J. H. Williams and Company's new "Superchest" contains an amazing combination of "Supersockets" and attachments in 1/4, 3/8, 1/2 and 3/4-in. drives; "superrenches," pliers, chisels, screwdrivers, etc., totaling 146 pieces in all. Every tool has been carefully selected to cover a wide range of work from ignition and electronics to truck, bus and industrial applications.

(20) Oil Filter

A new transmission oil filter that continuously cleans gear oil of grit, grime and abrasives has been announced by the Fuller Manufacturing Company, Kalamazoo, Michigan. The filter is designed for use on Fuller Transmissions, and most other makes as well.

Gear oil is kept clean during the interval between changes, resulting in longer life of bearings, bushings and transmissions. This longer life of parts also results in reduced parts costs, less labor and downtime.



IN field after field petroleum men are switching to TM Chain for its safety... for its trouble free dependability... for its long life and economy. Yes, they have learned that TM Chain is the life line of any pipe line. They have learned that TM Tire Chains help carry supplies in spite of mud, snow or ice—they have learned that TM Hi Test Chain helps to keep rigs going under the most grueling conditions.

The reasons are as simple as one, two, three—Taylor has been making chain for seventy-five years; the men who fabricate TM Chain have been at it most of their lives; the materials they use are made to Taylor's tried and proved formula.

There's a TM Chain jobber near you. Contact him or write direct. S. G. TAYLOR CHAIN COMPANY, 104 141st Street, Hammond, Indiana.

TAYLOR MADE Chain

"THE BEST BY TEST SINCE 1873."

(21) Casing Hanger

A revolutionary means of putting casing weight down the hole and relieving critical loads on long, slender unsupported outer casing string on off-shore and other water locations has been announced by Oil Center Tool Company, Houston, Texas.

This new O-C-T "Down the Hole Hanger" puts the weight on the outer string at a point where solid formation supports it, says the manufacturer, and thus eliminates the column load which causes columns of high slenderness ratio to buckle and bend under load. The O-C-T "DH-1" Casing Hanger also eliminates the chances of dropping the inner strings in case of surface accidents to completed wells.

(22) Crowfoot Attachments

J. H. Williams and Company combined, through the medium of one tool, the flexibility of the detachable socket system with all the advantages of the open-end adjustable wrench.

Williams new adjustable crowfoot attachments, when used with the numerous handles and parts available, present an endless variety of combinations which previously did not exist. They will perform nut turning jobs that were never thought possible.

PROVIDING THE POWER
for Pipe Line Pumping

Enterprise Diesels now provide *more* power at greatly reduced cost per horsepower to meet the most exacting demands required in pumping service. Substantial economies are offered through 1) simplicity of connection and control, 2) high torque at all speeds, and 3) elimination of transmission losses. They are designed and built to withstand heavy punishment from excessive pumping loads. Smooth, even, vibration-free operation is characteristic of this precision equipment.

Whatever your pumping power requirements, check Enterprise Diesels first. You'll find them flexible to your needs, using Diesel oil, modified crude oil, natural gas or dual-fuel. Normally aspirated or turbocharged up to 1800 HP per unit. Write or call for information on your particular power problems.

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(23) Hexadecene

Houdry Process Corporation has announced availability in research quantities of hexadecene, a moderately priced olefin raw material which has interesting possibilities in organic syntheses. Besides its utilization in numerous olefin reactions, hexadecene should be of interest because of some of its physical properties which include: Boiling point, 242 C; pour point, less than —50 C; flash point, 90 C; viscosity, 38 C, 3.57 centistokes, 54 C, 2.57 centistokes, 99 C, 1.33 centistokes.

(24) Airlarm

Airlarm is a low pressure warning device which sounds a shrill alarm when the pressure in any compressed air system or line falls below the minimum pressure for safe or efficient operation. Airlarm is unique in that it is completely mechanical and fully automatic. The alarm continues to sound as long as the air pressure is less than that for which the valve is set. Airlarm is made of non-corrosive materials and is available in two models: The adjustable type and the non-adjustable type.

(25) Diesel Unit

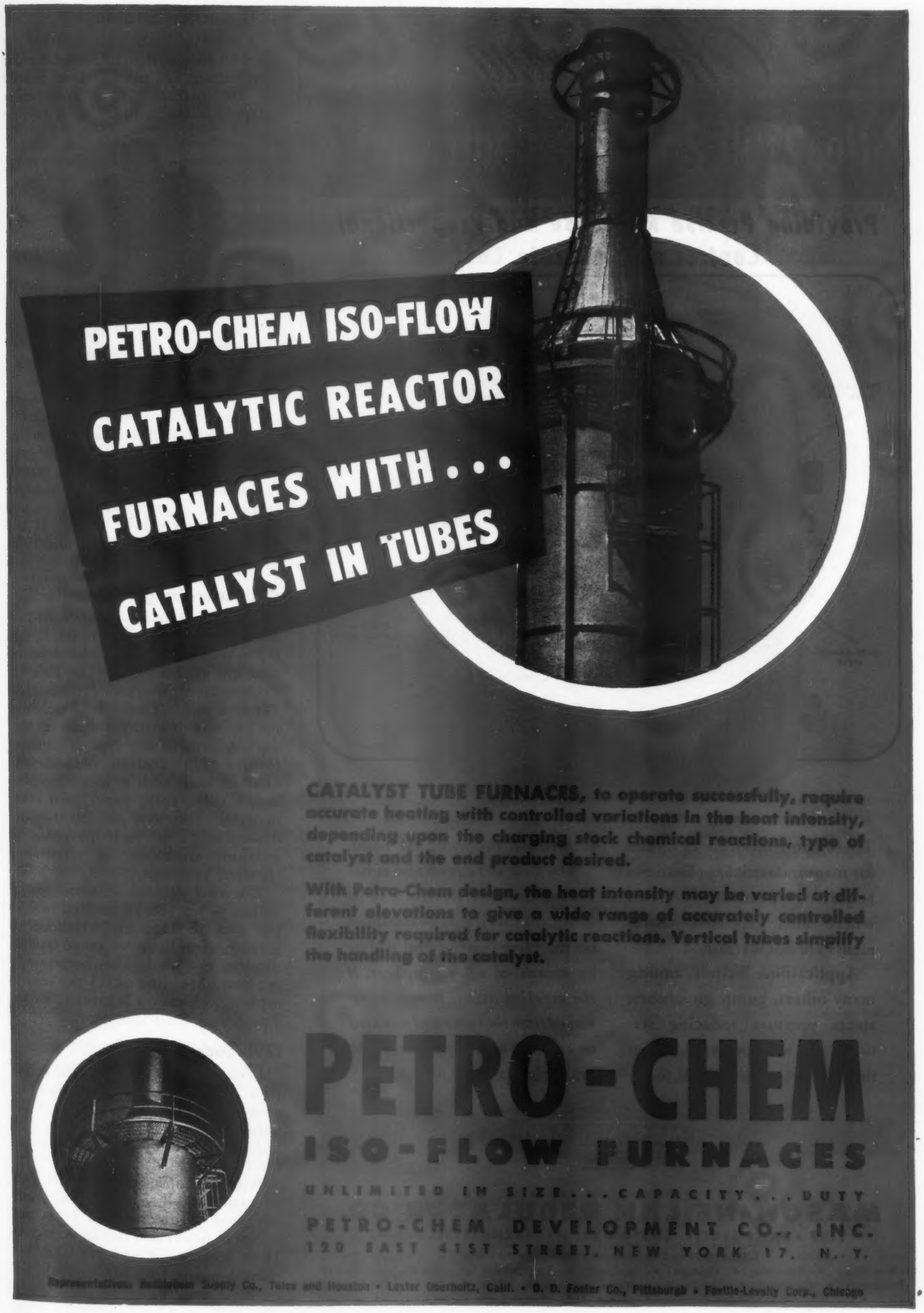
What is believed to be the first "packaged" diesel power unit capable of providing both electricity and mechanical driving power simultaneously has been announced by the Murphy Diesel Company, Milwaukee, Wisconsin, who call their new power plant, the MECH-ELEC unit. Any fixed or variable proportions of mechanical and electrical loads can be handled provided the combined total does not exceed the rated capacity of the engine and that the electrical load does not exceed 50 kw. Generator can be operated without engaging mechanical drive.

(26) Vacuum Water Stills

Designed to produce highest purity distilled water, by utilizing low pressure exhaust steam as the heating medium, the completely-new Stokes Multiple Effect Vacuum Water Still is now available for general industrial service.

The new Stokes water stills can be operated by steam at low pressures discarded by plants from process equipment vessels, turbines, or steam pipes. Models range in capacity from 150-1000 gph.

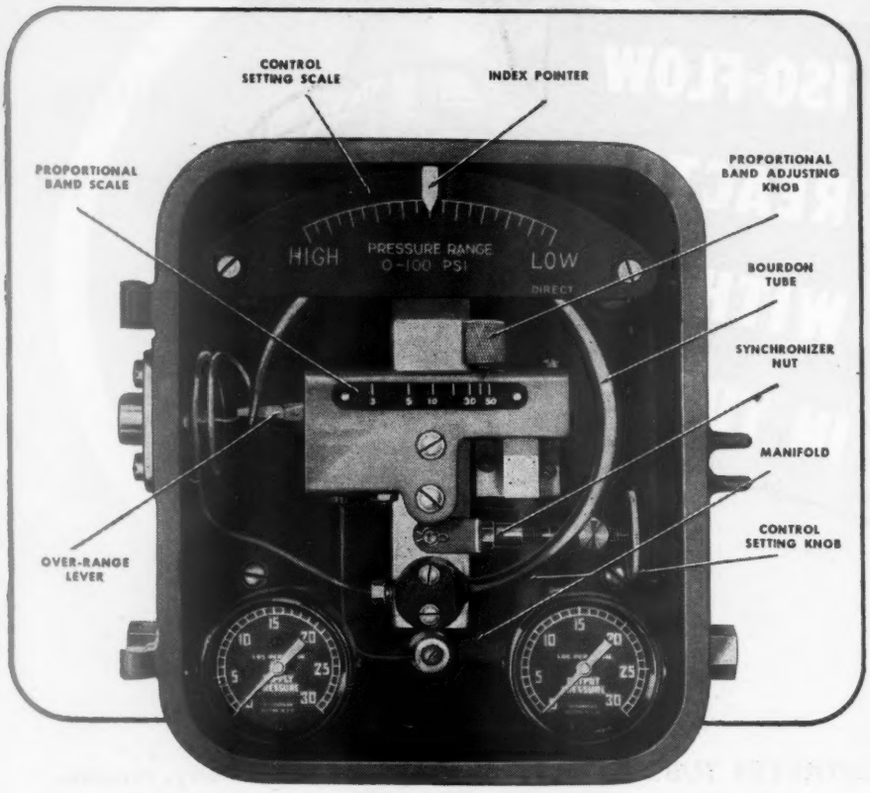
Of particular importance is the high heat transfer coefficient through the design characteristics of the inside and outside calandrias. Another outstanding feature is the use of special double centrifugal entrainment separators, assuring water of purity.


PETRO-CHEM ISO-FLOW
CATALYTIC REACTOR
FURNACES WITH . . .
CATALYST IN TUBES
CATALYST TUBE FURNACES, to operate successfully, require accurate heating with controlled variations in the heat intensity, depending upon the charging stock chemical reactions, type of catalyst and the end product desired.
With Petro-Chem design, the heat intensity may be varied at different elevations to give a wide range of accurately controlled flexibility required for catalytic reactions. Vertical tubes simplify the handling of the catalyst.
PETRO-CHEM
ISO-FLOW FURNACES
UNLIMITED IN SIZE . . . CAPACITY . . . DUTY
PETRO-CHEM DEVELOPMENT CO., INC.
120 EAST 41ST STREET, NEW YORK 17, N. Y.
Representatives: Petroleum Supply Co., Tulsa and Houston • Lester Oberholtz, Calif. • O. D. Foster Co., Pittsburgh • Ferrille-Lovatty Corp., Chicago

Announcing

No. 2700 Pressure Controllers

Providing Precise Response and Proportional Control at Moderate Cost



These controllers are designed for many industrial applications requiring accurate control where more expensive instruments are not warranted.

Applications include, among many others, pump governors, steam pressure reducing stations, gas well pressure reduction, etc., requiring small to intermediate proportional band.

The case is rugged and suitable for outdoor service; it is so designed that it may be mounted on the valve (on integral pad or by means of a U-clamp) or, *if the occasion arises, it may be removed from the valve and mounted on a wall.* A flush type case is also available for panel mounting.

MASONEILAN

MASON-NEILAN REGULATOR CO.

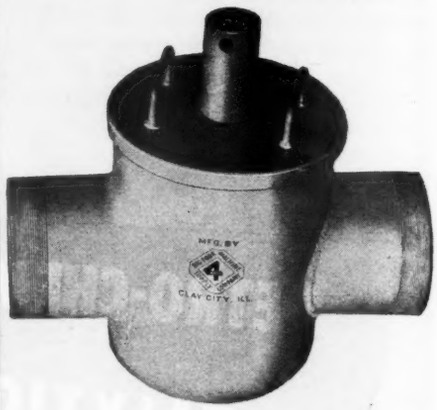
1187 ADAMS STREET, BOSTON 24, MASSACHUSETTS, U. S. A.

Sales Offices or Distributors in the Following Cities

New York • Syracuse • Chicago • St. Louis • Philadelphia • Houston • Denver
Pittsburgh • Cleveland • Cincinnati • Tulsa • Atlanta • Los Angeles • San Francisco
Mason-Neilan Regulator Company, Ltd., Montreal and Toronto

(27) Suction Strainer

A new type suction strainer for use on mud pumps, mud lines and similar applications has recently been placed on the market. It is specifically adapted to the industry as it can be



dismantled, cleaned and reassembled in less than 10 min. The strainer is composed of four parts: body, screen, cap and nut. Overall length of the new strainers is approximately 26 in. and weight approximately 200 lb. It will be available in 4-in., 6⅝-in. and 10¾-in. sizes.

(28) Low-Range Air Cells

Two new Tate-Emery air cells having load ranges of 0-1.2 to 0-6 lb and 0-2 to 0-10 lb in tension and compression are announced by The Baldwin Locomotive Works, Philadelphia, Pennsylvania. These load-weighing devices were designed for use on testing machines of any type or capacity to give high precision measurement of small loads such as in testing plastics, textiles, cord, paper, and other material. They can also be used independently for such purposes as weighing chemicals, or controlling chemical processes.

Accuracy of load measurement is within ¾ per cent of reading or 0.15 per cent of capacity, whichever is greater, when Bourdon gauge type indicators are used. This becomes ½ per cent of reading or 0.1 per cent of capacity, whichever is greater, for the Tate-Emery load indicator.

(29) Sockets

Recent additions to Williams impact "Supersocket" line have increased the number of sockets in the various styles and sizes to over 150, making an extremely wide and versatile range.

Williams impact "Supersockets" are adaptable to all socket locking methods used on the various types and makes of power and impact wrenches. Their accurate fit and precision machining assure long life and safe, dependable service.

(30) Telephone System

Employing improved carrier techniques, a new multichannel telegraph system, providing up to 18 duplex circuits—or speech plus 6 duplex circuits—for each 4-wire voice channel, has been developed by Federal Telephone and Radio Corporation, Clifton, New Jersey. This system can be used to economically provide the transmitting facility for a multiplicity of services, including telegraph, speech plus telegraph, teletype, telemetering, and supervisory control, required for the present day operation of railroads, pipelines, government agencies, utilities, and other private industrial enterprises.

Flexibility is the outstanding feature of the FTR 9-E-1 equipment. Since individual transmitter and receiver panels are provided for each channel, any number of channels may be installed initially. More channels can then be added (up to the maximum number) as traffic requirements dictate their need.

(31) Electric Heater

Heating hazardous locations safely, efficiently and at reasonable cost has been solved by the newly developed Electromode all-electric explosion-proof heater, according to announcement made by the manufacturer. This heater is said to be the first all-electric explosion-proof heater made to comply with Underwriters' Laboratories Class 1, Group D, Hazardous Locations. It was recently approved by the Underwriters' Laboratories, Inc. The heater is specially designed for use in atmosphere containing gasoline, petroleum, naphtha, acetone, benzol, lacquer, solvent vapors and natural gas.

The heaters have numerous applications in hazardous locations such as: pipe line offices, pump stations, valve houses, meter houses, bulk gasoline stations, refinery buildings and similar locations in the petroleum industry.

(32) Continuous Cast Method

Asarcon 773 is the trade name of the new continuous cast method of producing production and maintenance bearing bronze having 83 per cent copper, 7 per cent lead, 7 per cent tin, 3 per cent zinc, meeting SAE 660 specification.

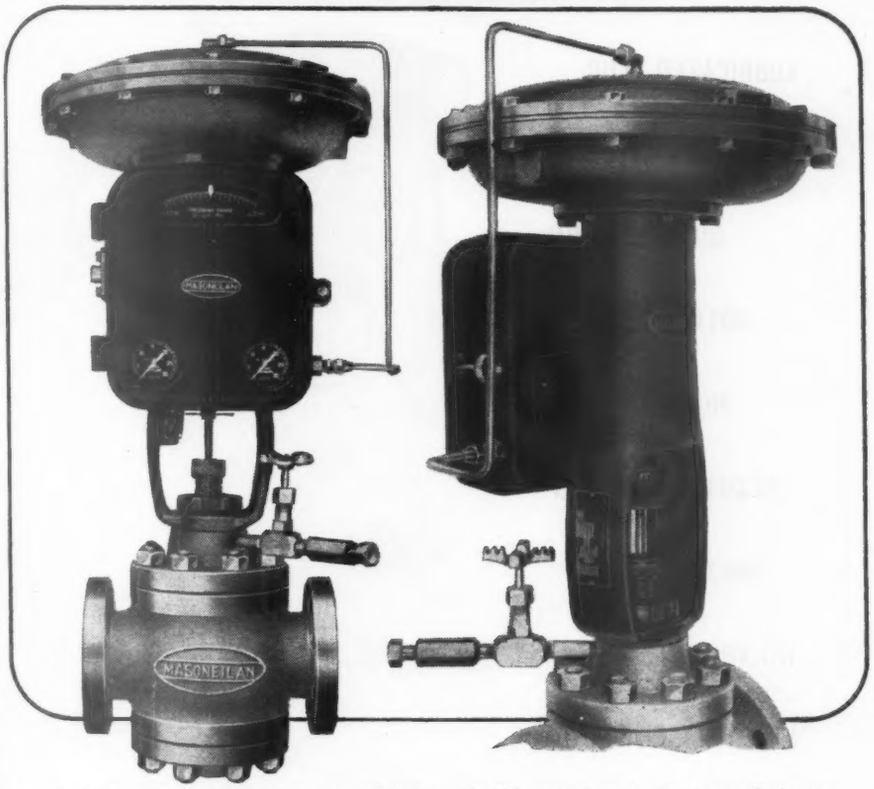
This material is being produced under a patented process by the American Smelting and Refining Company for Ampco Metal, Inc., Milwaukee 4, Wisconsin.

The continuous cast method assures the consumer of dense solid metal free of porosity, dross or sand inclusions and superior performance with longer life on the job.

Check These Outstanding Features of the New

No. 2700 Pressure Controllers

Providing Precise Response and Proportional Control at Moderate Cost



1. Pneumatic proportionality accomplished with feed-back bellows and cantilever leaf spring.
2. Direct nozzle and flapper pilot with metering restriction.
3. Large powerful bourdon tube for greater response and control performance.
4. Adjustable proportional band between 3% and 50%.
5. Wide selection of pressure ranges.
6. Cases for valve or wall mounting; also flush panel mounting.
7. Ease and accessibility of adjustments.
8. When steel construction is specified, controlled pressure connection, tubing to bourdon tube and entire bourdon tube assembly, are supplied with Type 316 Stainless Steel, in order to avoid corrosive effects.
9. Unit construction (proportional mechanism, nozzle block, etc.) and manifold.
10. Control action reversible with either bourdon or bellows.
11. Manifold construction prevents transmission of any possible case distortion to control mechanism.
12. Set point indication.

MASONEILAN

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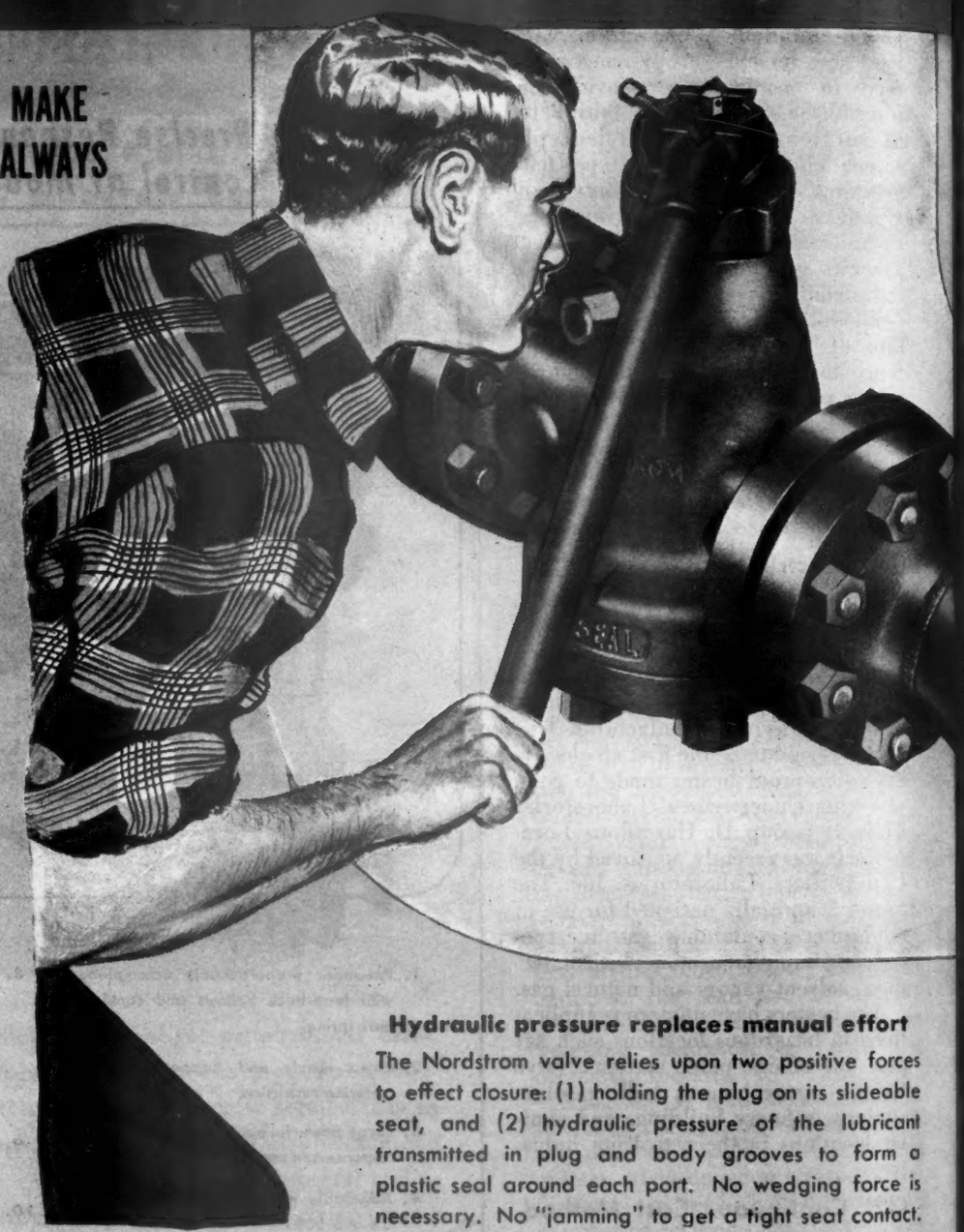
Pittsburgh • Cleveland • Cincinnati • Tulsa • Atlanta • Los Angeles • San Francisco
Mason-Neilan Regulator Company, Ltd., Montreal and Toronto

IT'S EASY TO TURN THIS VALVE

NORDSTROM VALVES MAKE OPERATION EASIEST—ALWAYS

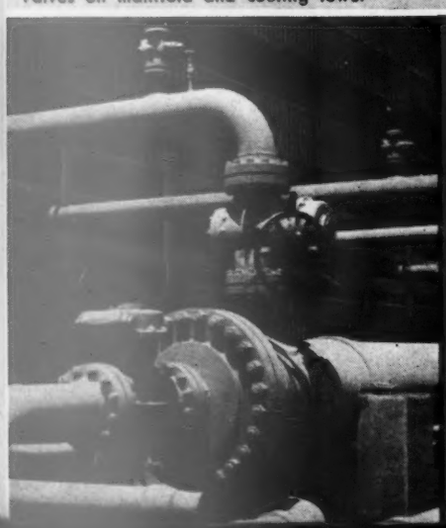
- LUBRICATED PLUG
- "SEALDPORT" SYSTEM
- QUARTER-TURN
- ROTARY ACTION
- NON-GALLING
- RESILIENT SEATING
- UNEXPOSED SEAT
- NO VOIDS TO CLOG
- STREAMLINED FLOW
- SMOOTH INTERIOR
- CORROSION-RESISTANT
- EROSION-RESISTANT



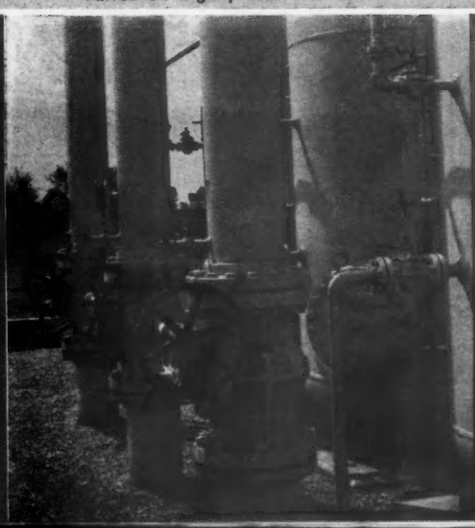
Hydraulic pressure replaces manual effort

The Nordstrom valve relies upon two positive forces to effect closure: (1) holding the plug on its slideable seat, and (2) hydraulic pressure of the lubricant transmitted in plug and body grooves to form a plastic seal around each port. No wedging force is necessary. No "jamming" to get a tight seat contact.

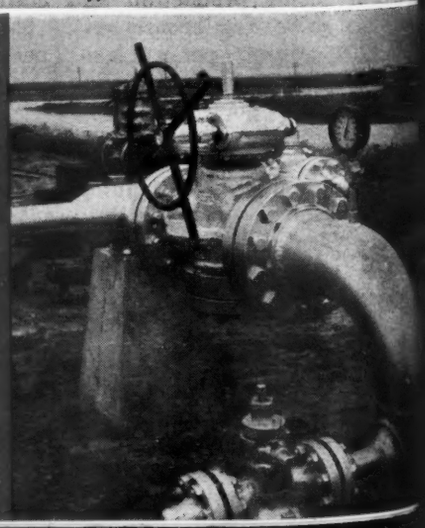
Valves on manifold and cooling tower



Valves on high pressure scrubber

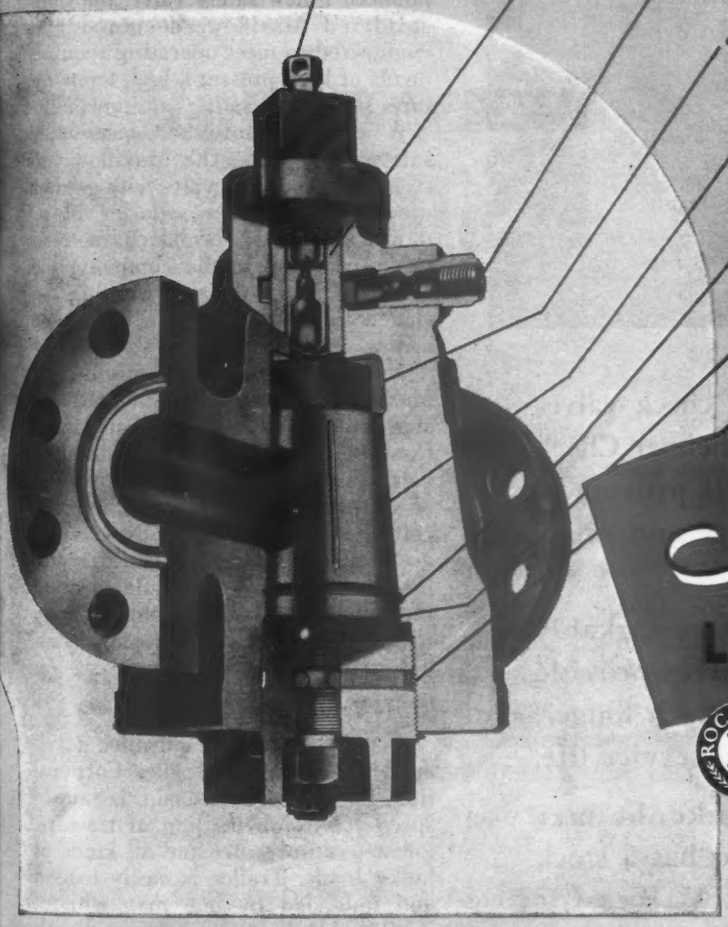


Hypreseal valves in dehydration plant



....you don't have to force it!

CHECK THESE POINTS OF SUPERIORITY



- EXTERNAL LUBRICANT SCREW OR GREASE GUN APPLIES INTERNAL PRESSURE (TO SEAL, JACK AND LUBRICATE)
- THREADED STEM IS SEALED BY STEM PACKING
- STEM PACKING CAN BE INJECTED WHILE VALVE IS IN OPERATION
- FLOATING EQUALIZER TRANSMITS TORQUE FROM STEM TO PLUG
- FULL FLOATING PLUG IS BALANCED UNDER HIGH PRESSURES
- LUBRICANT GROOVES IN PLUG CONNECT WITH BODY GROOVES TO FORM POSITIVE SEAL AROUND PORTS
- SINGLE BALL THRUST BEARING APPLIES THRUST AGAINST SPRING TENSION DISC UNDER PLUG
- ANNULAR SEALING GROOVE, FILLED WITH PLASTIC STEM PACKING, SEALS BOTTOM PLUG AND ADJUSTING SCREW

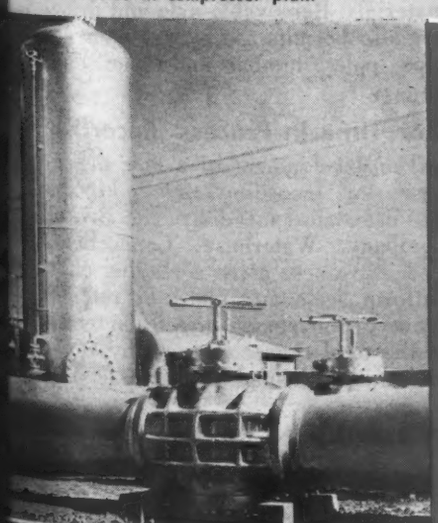
Nordstrom
LUBRICATED VALVES

ROCKWELL

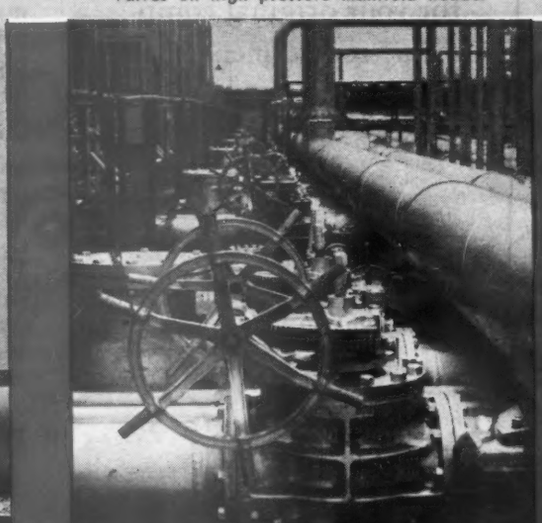
NORDSTROM VALVE DIVISION
Rockwell Manufacturing Company
400 North Lexington Ave., Pittsburgh 8, Pa.

Atlanta Boston Chicago Houston Kansas City Los Angeles New York Pittsburgh
San Francisco Seattle Tulsa ... and leading Jobbing Houses
Export: Rockwell International Corporation, 7701 Empire State Bldg., New York 1, N.Y.

Valves in compressor plant



Valves on high pressure manifold header



High pressure Christmas tree valves

BY the very nature of their service, check valves must be dependable. That Lunkenheimer Check Valves provide this kind of service is proved by innumerable installations, in plants large and small, throughout the nation.

Recognized by leading valve users as remarkably trouble-free, Lunkenheimer Check Valves provide positive reverse-flow protection over a much longer, lower-cost service life.

Your Lunkenheimer Distributor has a stock of Check Valves for your needs. Call on him for your original equipment, replacement, and repair valve requirements.

. . . More than 96 types of LUNKENHEIMER *Check Valves*

Available in sizes and materials to meet every service requirement.

From small Bronze 125 lb. S.P. to massive steel patterns for pressures up to 2500 lb. S.P.

Lunkenheimer Check Valves are described and illustrated in Circular Number 588. Ask your Distributor for a copy or write direct.

ESTABLISHED 1862
THE LUNKENHEIMER CO.
"QUALITY"
CINCINNATI 14, OHIO, U. S. A.
NEW YORK 13 CHICAGO 6
BOSTON 10 PHILADELPHIA 34
EXPORT DEPT. 318-322 HUDSON ST., NEW YORK 13, N. Y.

(33) Packer

A modified upside down packer featuring a new design which provides for two methods of packer release has been developed by Larkin & Company, Inc., Butler, Pennsylvania.

This packer, known as the Larkin "PRM" upside down packer, is recommended for holding pressures on input injection wells with either air, gas or water drives. Other applications include the acidizing of production wells by use of acids under pressure and for plugging purposes with various types of gel under pressure.

(34) Safety Valve

Manning, Maxwell & Moore, Inc., Bridgeport, Connecticut, today announced a new safety valve, the Consolidated Maxiflow, designed and engineered to meet operating requirements of high pressure, high temperature, steam generating equipment.

A new addition to the Consolidated safety valve line, the Maxiflow answers the need for a valve with greater discharge capacity, shorter blowdown, and other special characteristics. According to the company, the Maxiflow is the through bushing designed to function with a blowdown as low as 1 per cent.

Another feature of the Consolidated Maxiflow is the through-bushing design which has been associated with Consolidated high pressure safety valves since their inception. By the use of a through-bushing, possible difficulties due to porous body castings are entirely eliminated. The pressure medium is completely isolated from the body casting and contained wholly within a homogenous corrosion resistant stainless steel forging.

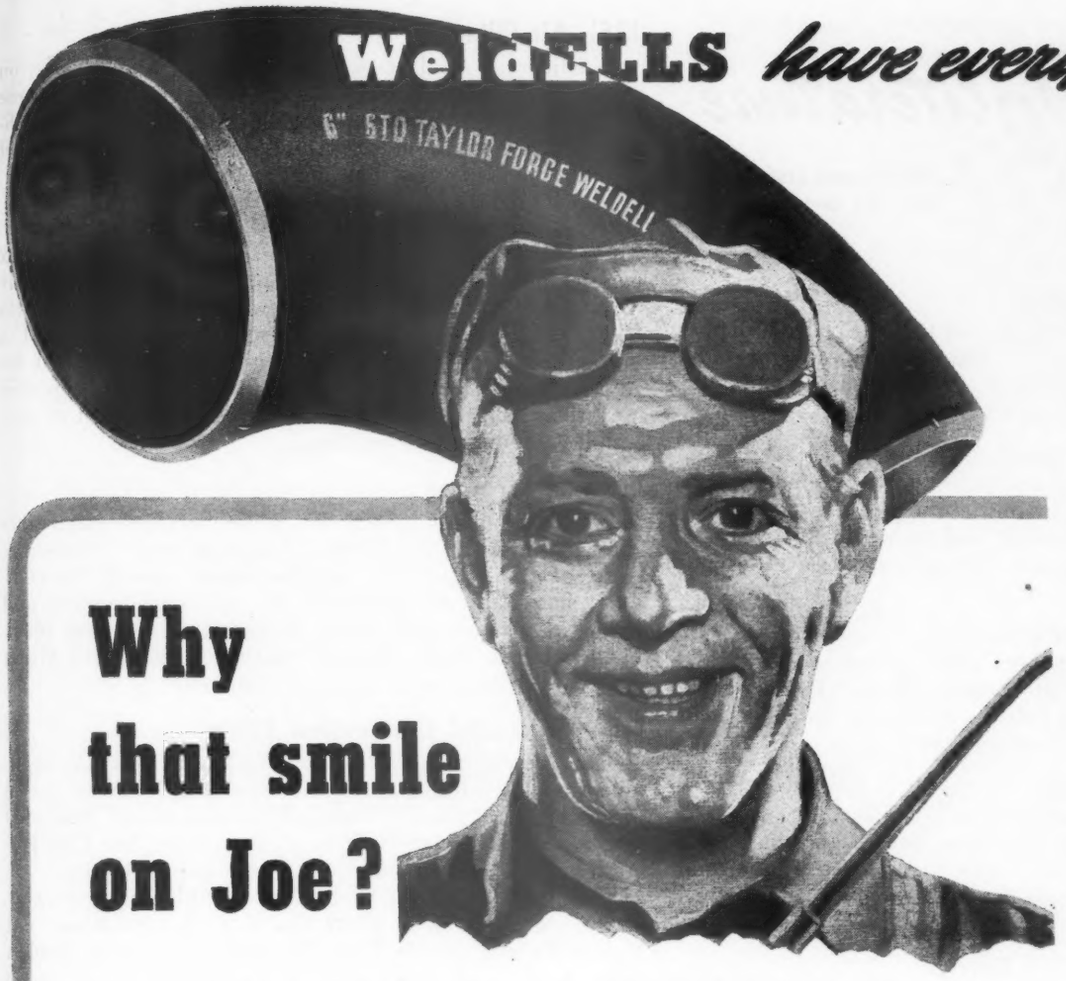
(35) Trailer

New 8-10 ton tilting trailer developed by La Crosse Trailer Corporation, La Crosse, Wisconsin, is said to speed job-to-job hauling of tractors, mixers, compressors and all kinds of bulky loads. Trailer is easily loaded and unloaded by one man without skids or blocks and can be used with stakes or box sides for hauling various materials. Removable axle and drawbar also permits use for transporting pipe, poles, lumber and other long objects.

(36) Time-In-Process Recorder

The development of a new instrument for recording time-in-process has been announced by The Bristol Company, Waterbury, Connecticut. The instrument gives a reading on a uniform scale and chart of rate of conveyor movement, directly in terms of the total time consumed by work in traveling through a process.

WeldELLS *have everything...*



Why that smile on Joe?

Joe may not know much about the engineered strength of WeldELLS, or the metallurgical control, or the greater scope of the WeldELL line. However, it is plain enough that these considerations which mean so much to you begin to lose meaning unless Joe does *his* part of the job right.

That's why we designed WeldELLS, not only for you, but also for Joe. That's why Joe smiles: A good Welder like Joe takes extra pride in the kind of job he can turn out when it's made easy for him by these easily identified fittings, with sized end tangents, cleanly machined bevels, precision quarter markings to speed lining up, accurate key dimensions, plus other conveniences that are combined only in WeldELLS.

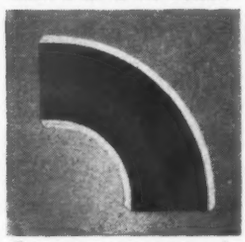
Yes, Joe does a better job with WeldELLS . . . and in the final analysis, *your* work rests on Joe's work!

Remember that the line which offers the most to both you and Joe, also contains the most complete range of sizes, thicknesses, and types of fittings, *and* in a complete range of materials. Convenient stocks are carried in all industrial centers.

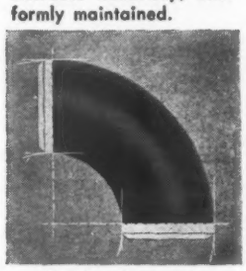
Note these features that appeal to the man on the job:

No guess-work; markings clear and complete.

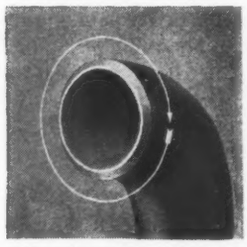
Precision quarter marks mean a lot to the welder.



Extreme accuracy, uniformly maintained.



Sized end tangents.



Cleanly machined bevels.

TAYLOR FORGE

TAYLOR FORGE & PIPE WORKS General Offices & Works: Chicago 90, Ill. (P.O. Box 485). Eastern Plant: Carnegie, Pa. Western Plant: Fontana, Calif. • District Offices—New York: 50 Church Street • Philadelphia: Broad Street Station Bldg. • Pittsburgh: First National Bank Bldg. • Chicago District Sales: 208 S. LaSalle Street • Houston: City National Bank Bldg. • Los Angeles: Subway Terminal Bldg.

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trade literature

PUBLICATIONS LISTED ARE SENT FREE UPON REQUEST

(27) Tubular Heaters

Catalog 54, part 5, section 3, of Black, Sivalls & Bryson, Inc. discusses tubular heaters. The types of heaters available are illustrated and described. Pressure and temperature charts and specificatons for each are included.

(28) Carbureted Engines

Industrial engines and equipment for their operation on gasoline, kerosine, distillate or natural gas in a wide variety of applications, are described and shown by International Harvester Company in a new 12-page catalog covering four carburetor-type engines.

(29) Mechanical Controls

Otis Pressure Control, Inc., offers a reprint titled, "Mechanical Controls for High-Pressure Wells." Tubing safety valves and flow line safety valves reduce the possibilities of damage to equipment where pressure is great.

(30) Welding Fittings

Globe Steel Tubes Company has published a new Globe welding fittings catalog. Precision process production is used in the manufacture of Globe seamless steel tubes and welding fittings. Dimensional tolerances for seamless steel butt-welding fittings are listed with other information.

(31) Blast Furnace Gas Burner

Peabody Engineering Corporation, New York City, has just published a two-color bulletin on their complete line of blast furnace gas burners.

The bulletin includes not only blast furnace installation pictures but cross-section drawings of various other types of burners for waste and primary fuels.

(32) Cathodic Protection

A new 8-page 2-color booklet announced by the Westinghouse Electric Corporation contains information which will be of value to refinery, pipe line, and central station operators, and to other industries having underground structures, piping, or other exposed equipment that suffers from corrosion due to electrolytic action.

The booklet contains complete descriptive information, line diagrams, installation and equipment photographs, and specification data and ratings on the various sizes and types of Rectox cathodic protection available for wall or pole mounting.

(33) Weldirectory

Another in the series of bulletins by the Lincoln Electric Company, is Weldirectory for Non Ferrous Metals. "Aluminweld," for welding aluminum, and "Aerisweld," for shielded arc welding of bronze, brass and copper, are featured.

(34) Silicone Plant

A 12-page bulletin illustrating the General Electric Company's new silicone manufacturing facilities at Waterford, New York, has been issued.

The bulletin is a pictorial introduction to the complexities of silicone manufacture rather than a source of technical information. Included are brief descriptions of the outstanding characteristics and principal uses of G-E silicone resins, oils, greases, rubber, and water repellents.

(35) Air Filters

Continental Air Filters, Inc., announce a new leaflet on automatic self-cleaning air filters. This filter embodies three valuable features: New filter media with high cleaning efficiency and constant, low resistance to air flow; ferris wheel action, and positive self-cleaning action.

(36) F-M Telegraph Systems

Stability, margin, and range for teleprinter and multiplex applications are listed as prominent features of the Lenkurt Type 22 telegraph system described in a new folder, Form 22P4. This publication illustrates the arrangement of a single channel of the equipment, shows the design of individual transmitter and receiver panels and lists six specific ways in which this basic equipment can be applied to telegraph communication problems.

(37) Perforation

The new bulletin of the Welex Jet Services, Inc., gives information about the Welex Jet method and services. Because of its high velocity and directional control, the company states, the Jet penetrates through steel, cement and formation farther and faster. In the standard steel block test the Jet penetrates through four-in. of mild steel. Great control with no casing damage is claimed.

(38) Data and Conversion Tables

The Babcock and Wilcox Tube Company now has available the latest editions of five tables which should be useful to engineers or anyone dealing with steel tubing. Included in the material are the following data cards: No. 115, Tolerances of Round Seamless Steel Mechanical Tubing; No. 112, Metric Conversion Table; No. 110, Linear Conversion Table; No. 103, Wall Thickness Data for Seamless and Welded Tubing, and No. 125, Hardness Conversion Tables.

(39) Gravity Instruments

Gravity instruments for measurement of specific gravity of liquids are illustrated in a brochure by the American Recording Chart Company. Arcco-Anubis liquid gravitometers record the specific gravity of a continuously flowing sample of liquid under actual line operating conditions. The gravitometer operates under high working pressure. It also determines the composition of mixed liquids, such as propane-butane mixtures. Three features of Arcco-Anubis gravitomers are 1. accurate measurements, 2. instance recording, and 3. minimum of attention.

(40) Air Compressors

Worthington Pump and Machinery Corporation announces the availability of a new selection chart, based on normal applications handling air with atmospheric intake pressure.

The chart simplifies selection of proper size compressor for average industrial use, with quick comparison between discharge pressure psig, and piston displacement cu ft per min, and shows recommended compressor bore and stroke.

(41) Instrument Transformer

An 80-page booklet containing detailed information on 107 types of standard instrument transformers manufactured by General Electric has been announced by the G-E meter and instrument divisions.

Fully illustrated, the 1949 Buyer's Guide gives prices, ratings, and ASA accuracy classifications of G-E instrument transformers for both indoor and outdoor use. These include potential transformers, current transformers, metering outfits, and portable transformers.

Also included in the booklet are tables which give the mechanical and thermal limits of current transformers based on the latest ASA Standards.

(42) Insulation

A 4-page folder, "Zerolite Insulation," presents the new Johns-Manville insulation for low temperature service. It provides essential data on sizes, temperature limits, conductivity, strength, water absorption and combustibility.

(43) Tank Roof

The Chicago Bridge and Iron Company, Chicago, Illinois, announces the publication of a new 4-page leaflet, "The Vapordome Roof." This leaflet describes the use of a Vapordome Roof on a flat-bottom oil storage tank to prevent evaporation losses caused by daily breathing. A cutaway view of a tank with a Vapordome Roof shows the flexible membrane in the dome at the center of the roof. The leaflet includes a table of standard Vapordome Roof sizes.

(44) Sectional Drive Groups

The National Supply Company has issued a bulletin on Ideal Type "AS" sectional drive groups for engines in the 300-hp range to be used with Types 75, 100, and 125 consolidated drilling rigs. Drive group sections are independent units comprising an engine base, extension shaft, Fawick Airflex engine clutch and compounding sprocket for 1½-in. triple compounding chain.

(45) Galvanic Cell Corrosion

Reasons for galvanic cell corrosion, as well as methods for helping to overcome it, are contained in a new booklet issued by The International Nickel Company's corrosion engineering section.

The booklet is complete in all engineering details and includes drawings and other essential illustrative material. Its seven and one-half pages are designed to provide the production man as well as the engineer with brief but informative material.

(46) Starters

The Allis-Chalmers line of alternating-current full voltage starters to meet the requirements of any type of motor drive is described in a new 12-page bulletin.

Construction features and uses of manual and magnetic across-the-line starters, across-the-line combination starters, reversing starters, and push-button control stations are all described and illustrated.

(47) Water Level Gage

The Trulevel gage, manufactured by the Jerguson Gage and Valve Company, brings the accurate reading of boiler water levels down to easy-readying level at any convenient position remote from the boiler drum. The features of this gage are discussed in a leaflet released by the company.

(48) Sales Training

Two new pocket-size sales training booklets devoted to "Premier" spring wire have been issued in the United States Steel sales program designed to provide retail salesmen with the inside story on the steel used in producing household articles they sell to the public.

The two booklets are: "The Inside Story of Premier Spring Wire," and "The Inside Story of How Premier Spring Wire Is Used."

(49) Industrial Thermometer

Exceptionally interesting and informative is a new bulletin just issued on the Dillon stainless steel thermometer. The instrument covers practically every industrial use—with features not found in usual fluid or expansion types. The unit is safely used under conditions of severe vibration, corrosion or shock. With long stem length, it checks deep vats where there is heat variation top and bottom.

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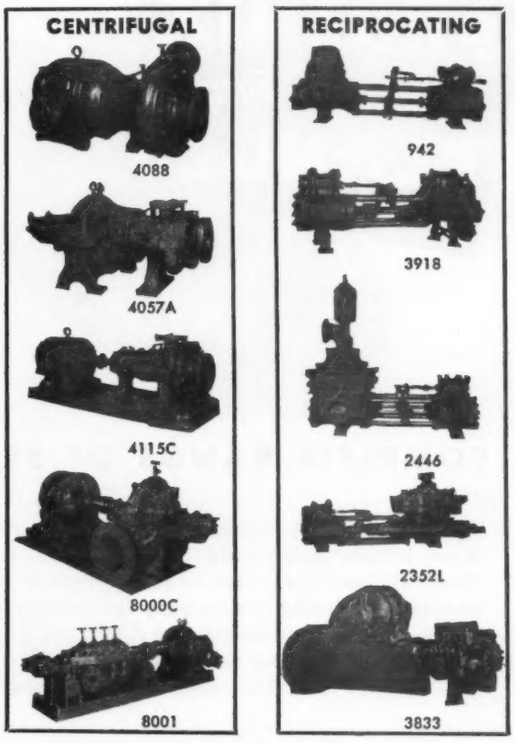
PUMPS

BUILDERS OF OUTSTANDING PUMPS SINCE 1869



BRANCH OFFICES: NEW YORK HOUSTON

(50) Silicone Rubber

A 24-page illustrated bulletin describing G-E silicone rubber has been issued by the plastics division of the General Electric Company's chemical department.

Devoted to the heat resistant, mechanical, electrical, and chemical resistant properties of G-E silicone rubber, as well as applications for the material, the bulletin discusses fundamentals of silicone chemistry and the performance of the rubber under varied conditions. Property tables are included for reference.

(51) Diesel Units

A brochure by General Motors Corporation, describes the GM series 71 diesel units equipped with the GM torque converter, in the 3, 4 and 6 cylinder sizes. Specifications, typical torque characteristics, and power unit performance curves are included.

(52) Products Pipe Lines

"Interfacial Mixing Characteristics of Products in Products Pipe Lines," printed in *The Petroleum Engineer* in September and October, 1948, is now available in reprint form from the American Recording Chart Company. The article was written by S. S. Smith and R. K. Shulze of Shell Oil Company, Inc.

(53) Pumps

Characterized by a wide capacity range of up to 60,000 gpm against heads up to 300 ft, an augmented line of horizontal centrifugal pumps, for general purpose pumping of water and alkaline fluids at temperatures up to 300 F, is announced by Peerless Pump Division, Food Machinery and Chemical Corporation. This line of pumps, designated as Peerless Type A, is of single stage, double suction, split case design.

A COMPLETE RANGE OF STYLES

Welding neck, slip-on, socket, threaded, lap joint, blind, hillside, boiler spuds . . . the Phoenix line includes all these types. They're drop forged of mild steel perfectly suited to machining and welding and they meet ASA requirements and ASME and ASTM specifications in every case. The Phoenix Flange Catalog shows the full line. Request your copy today.

PHOENIX MANUFACTURING COMPANY

JOLIET, ILLINOIS △ CATASAUQUA, PA.

(54) Speed Reducer

A 44-page bulletin issued by Farrel-Birmingham Company, Inc., Buffalo, New York, contains complete information about the company's line of speed reducers which are now offered in a wider range of sizes and capacities.

The bulletin gives simple, easy-to-understand directions for selecting speed reducers of the horsepower and speed required. Contents include complete descriptions of units of the single and double reduction types, specifications, horsepower rating tables, overhung load capacities, dimensions and weights.

(55) Pipe Insulation

Two new booklets recently published by The Ric-wiL Company are of particular interest and practical usefulness to those who deal with problems involved in insulated piping distribution systems.

They are titled "Engineering Data for Underground Steam Distribution, Section 480-2," and "Typical Engineering Drawings—Section 480-3."

(56) Working Pressures

Maximum allowable working pressures for water-tube and fire-tube boilers have been assembled by The Babcock & Wilcox Tube Company in the form of a useful table which will serve as a handy reference. The table lists the maximum allowable working pressures psi for seamless and electric-resistance welded carbon steel tubes or nipples for different diameters and gages of tubes conforming to certain ASME specifications.

(57) Germicide

During the past few months tests in the fields and in the laboratories of Pur-O-San Company have been made with a new non-poisonous and non-corrosive surface active compound known as Pur-O-San to be used as an improved aid in the conditioning of the intake water used in secondary oil recovery operations. It is stated that Pur-O-San increases the wettability of the water and acts as a powerful bactericide and algea control agent.

(58) Filters

A brochure on Staynew filters for the removal of foreign matter from gases and liquids, featuring radial fin construction, has been released by the Dollinger Corporation, Rochester, New York. The double action principle guarantees both clean and dry air or gas. The liquid filters permit use of any medium that comes in sheet form and can be crimped.

(59) Dirtmover

Information on the new D Roadster Tournapull, one-man operated, self-leading dirtmover, is contained in a new broadside published by R. G. LeTourneau, Inc.

(60) Multi-Breaker Loadcenters

A new 4-page leaflet, "MO-2 and MO-4 Multibreaker Loadcenters," has been announced by the Westinghouse Electric Corporation.

The advantages of the loadcenters over fused equipment are discussed, and the new design features that provide for quick and easy installation and for better protection are described.

(61) Heat Exchangers

The design and service of four types of heat exchangers using "Karbate" as protection against corrosive fluids and gases are featured in a brochure by Foster Wheeler Corporation, New York.

The brochure shows other applications of "Karbate." Physical properties of "Karbate' 'and a table giving its resistance to a large number of acids, salt solutions, alkalies, organic compounds, and gases and mixtures are also shown.

Antitrust Laws, et al v. Unit Operation of Oil or Gas Pools, *by Robert E. Hardwicke. American Institute of Mining and Metallurgical Engineers, 29 West 39th Street, New York 18. Pages, 300. Price, $1.50.*

Written by a leading authority on the legal aspects of oil and gas conservation, this timely book will prove of interest to oil company executives, attorneys, and petroleum engineers. A lively, profusely-documented account is given of the efforts to solve conservation problems, including activities of federal and state governments and leading societies of the industry.

Adding much value to the book is the 5-division index. Indeed, the citations therein constitute an excellent bibliography of historical and legal phases of unit operation. The 80-page appendix contains valuable material that would not otherwise be easily accessible to the reader.

The Nature and Origin of Limestone Porosity, *by Richard B. Hohlt. Vol. 43, No. 4, Quarterly of the Colorado School of Mines, Golden, Colorado. Pages, 51. Price, $1.*

This paper analyzes existing concepts of the nature and origin of carbonate porosity including the hydrology of limestone terranes, and presents evidence for modification or expansion of some of these concepts. The major portion of the study is concerned with secondary porosity and with orientation found in the carbonates, this division being liberally illustrated by petrofabric diagrams and photomicrographs.

Among the conclusions reached is that a dolomite may be expected to develop better solution porosity than a limestone because of the high degree of random orientation common to most dolomites.

An Index of Shale-Oil Patents, *U. S. Bureau of Mines Bulletin No. 467, by Simon Klosky. Superintendent of Documents, Washington, D. C. Pages, 360. Price, $0.75.*

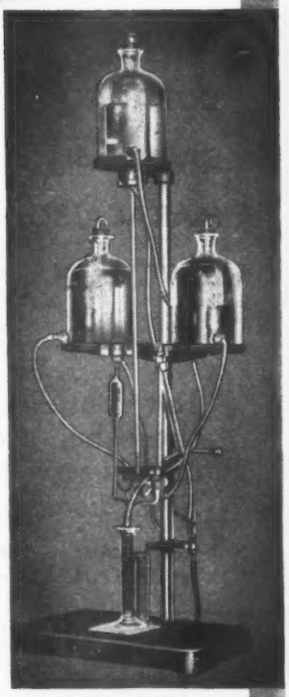
This volume of lists and classifications of patents dealing with shale oil and oil shale was compiled as part of the work directed by Public Law No. 290 passed in 1944. It includes the patents issued in the United States and four other English-speaking countires, Australia, Great-Britain, Canada, and Union of South Africa, and lists of patents issued by 10 European countries.

A list of inventors and assignees is included with each of these two main groups. On each patent is given its country designation, number, date of issue, title, patentee and assignee, and one claim or a brief description of the process patented.

Reports of Petroleum Committee, International Labour Organisation. *International Labour Office, Geneva, Switzerland. Price, Set of 5, $2.20.*

The first session of the Petroleum Committee of the International Labour Organisation was held in Los Angeles, California, in February, 1947. In the "Record of the First Session" are published the functions, composition and organization, proceedings, standing orders, and resolutions of the committee. The remaining pamphlets of the set are Reports I-IV of the second session of the committee, held in Geneva, November, 1948. Titles of the reports are: "General Report," "Recruitment and Training," "Safety in the Petroleum Industry," and "Industrial Relations."

SULFUR and CARBON *Analyses* in PETROLEUM PRODUCTS

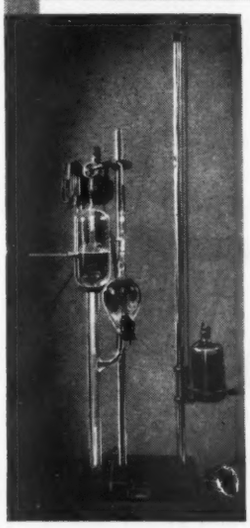


The sulfur content of oils, waxes and greases is often an important measure of the value and quality of the product.

Whether the desired sulfur content be high, low or medium, it is necessary to know exactly what amount is present.

The combustion method offers a rapid and sure means of determining sulfur in the wide range of percentages and materials encountered in the oil and grease field.

The Dietert-Detroit Sulfur Determinator embodies the correct principles of the combustion method in a simple, rugged and convenient form. It is supplied complete to operate as a self-contained unit, independent of other analytical equipment. Complete analysis can be made in less than five minutes.



Carbon determinations on organic compounds are being made in as little as two minutes with the Dietert-Detroit No. 3003 Carbon Determinator.

This method can be applied to any petroleum product that can be weighed into an open combustion boat. One example of the usefulness of this method is the analysis of cracking catalyst for carbon content.

Leading oil companies* are taking advantage of these versatile, time-saving determinators. Write for detailed information on how you can apply rapid carbon and sulfur analysis to your problems.

*Two typical users— { THE SHELL OIL COMPANY / THE PURE OIL COMPANY

Harry W. DIETERT Company
9330 Roselawn Ave. Detroit 4, Michigan
CONTROL EQUIPMENT · SAND · MOLD · MOISTURE · CARBON · SULFUR

BARCELONA
Now included in KLM's Great Oil Network...

★ ARUBA
★ CURACAO
★ CARACAS
★ MARACAIBO
★ BARCELONA

Now Barcelona, Venezuela joins the other great Caribbean oil centers served by KLM's famous *Royal Route from Miami.*

Leave MIAMI any TUESDAY or SATURDAY evening at 11:00 P.M. . . . lunch in Barcelona the next day!

		Tues., Thurs., Sat. CONSTELLATION	Tues., Thurs., Sat., Sun. DC-4
LV....	MIAMI	08:15	23:00
AR..	ARUBA	14:55	07:10
AR..	CURACAO	16:20	08:35
AR..	MARACAIBO	16:40	08:45
AR..	CARACAS	16:45	09:10
AR..	BARCELONA		Wed., Sun. 11:30

K·L·M ROYAL DUTCH AIRLINES
1919 30TH YEAR 1949

THE WORLD'S FIRST AIRLINE TO ACHIEVE ITS 30th ANNIVERSARY

SEE YOUR LOCAL TRAVEL AGENT or KLM Royal Dutch Airlines, 572 Fifth Ave., New York, N. Y. LU 2-4000; 308 N. E. 1st Street, Miami 3-8455. Other KLM offices in Los Angeles, San Francisco, Chicago, Washington, Boston and Montreal.

▸ **Ira Rinehart's 1949 Yearbook,** *edited by Frank J. Gardner. Rinehart Oil News Company, P. O. Box 1208, Dallas, Texas. Issued in two volumes. Price, $10.00 to Rinehart subscribers, $15.00 to non-subscribers.*

Detailed discovery information on new oil and gas fields found in the United States during 1948 makes up the bulk of this improved publication. Maps are presented on 22 states, 7 regions, and 70 individual oil fields. Tabbed divider pages have been added before each state or area and each division carries its own index. Other sections include a financial review of the industry for 1948, and yearly drilling and producton records in each state.

▸ **Wear as Applied Particularly to Cylinders and Piston Rings,** *by F. P. Bundy, T. E. Eagan, Ralph L. Boyer. The Cooper-Bessemer Corporation, Mount Vernon, Ohio. Pages, 129. Price, $3.50.*

The directors of Cooper-Bessemer's 10-year wear research project have collaborated in writing this book, in which their findings are described and generously illustrated. Each man has prepared a section dealing with the phase of the work he supervised. Bundy, now with General Electric Company's research laboratory, describes the theoretical research and laboratory experimentation; Eagan handles the metallurgical considerations, and Boyer, C-B vice president and chief engineer, describes design aspects of cylinder and ring wear. It is revealed how operators of gas and diesel engines today get up to 100 times the life in vital engine parts possible only 10 years ago.

▸ **1949 Texas Petroleum Directory,** *edited by L. V. Logan. Petroleum Personnel Research, 508 Richmond, Apt. 9, Houston 6, Texas. Pages, 288. Price, $10.00.*

The 1949 edition brings up to date, in so far as possible for this type of business, petroleum directory information published in 1947. Listed under 215 Texas cities are more than 34,000 companies and individuals. The publishers invite notification of omissions or errors.

▸ **Gas Hydrates and Their Relation to the Operation of Natural-Gas Pipe Lines,** *by W. M. Deaton and E. M. Frost, Jr., U. S. Bureau of Mines. American Gas Association, 420 Lexington Avenue, New York. Pages, 101. Price $1.50.*

This publication is a convenient handbook for those concerned with gas hydrates and their effect on the operation of natural-gas pipe lines. The monograph assembles previously published data of the Bureau of Mines and reviews certain data of other investigators.

Problems arising from the formation of hydrates and the methods used by operators to free the lines are discussed. Hydrate equilibrium data are given for a number of gases and dehydration plants of various types for drying natural gases are described. In fact, this report, resulting from Bureau of Mines research with monetary assistance and advice from the American Gas Association, thoroughly covers the subject.

▸ **Conservation of Oil and Gas, A Legal History—1948,** *edited by Blakely M. Murphy. Section of Mineral Law, American Bar Association, 1140 North Dearborn Street, Chicago, Illinois. Price, $3.00.*

The background of the conservation movement in 35 states, the federal government, and the Interstate Compact is given fair and unbiased treatment in this carefully planned volume. Legislative, administrative, and judicial interpretation and exercise of the conservation principle is summarized in a manner that will be useful not only to those connected with government and the legal profession but to all who have an active interest in conserving petroleum resources.